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Report of the Commissioner of Agriculture

North Carolina. Dept. of Agriculture

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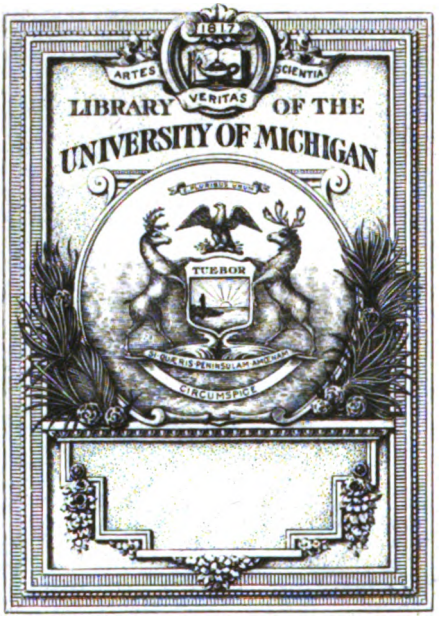

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North Carolina. Dept of agriculture.

BIENNIAL REPORT

OF THE

COMMISSIONER OF AGRICULTURE

WILLIAM A. GRAHAM, COMMISSIONER

RALEIGH, N. C., DECEMBER 1, 1914

RALEIGH:
E. M. UZZELL & CO., STATE PRINTERS AND BINDERS.
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BIENNIAL REPORT

OF THE

COMMISSIONER OF AGRICULTURE

N. C. Department of Agriculture,
Raleigh, December 1, 1914.

His Excellency, Governor Craig:

In compliance with section 3944 of the Revisal of 1905, I submit the following report of the operations of the Department of Agriculture for the years 1913 and 1914, to be transmitted to the Legislature with such reference as you may deem for the public welfare.

The advance which the adult farmer has made in knowledge of his profession and the results attained have never been surpassed, if equaled, by any people in the same length of time. The State has risen from the twenty-second to the thirteenth position as to value of its agricultural products. For the fifth successive year (including 1914) it is first in production of cotton per acre, having reached 315 pounds in 1911.

The Department received in 1913 from the American Pomological Congress the Wilder prize, which is the highest award. It had for three years received the sweepstakes prizes, and North Carolina apples are beginning to be recognized in the markets of the world. The State excels in amount of sweet potatoes and peanut crops; North Carolina compared with States of the so-called corn belt as to value of crop of corn upon an acre in 1913. The following statement is from the Year Book of the National Department for 1913: An acre of corn in North Carolina is worth $15.11; in Iowa, $15.05; Missouri, $14.72; Minnesota, $12; South Dakota, $11; Illinois, $16; Indiana, $16. The amount of corn is greater in the other States, but the price per bushel is higher here.

Our people are conservative, rather slow to adopt new ideas or to run after "imaginary" progress. The Department has approached them along lines of which they have some knowledge, and they have responded in a surprising manner. This has been the result of the teaching at the institutes and by practical demonstrations.

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The following are some statistics showing what has been done:

	1909			1913		
	Acreage.	Production, Bushels.	Per Acre.	Acreage.	Production, Bushels.	Per Acre.
Corn	2,439,457	34,000,000	13.8	2,835,000	55,282,000	20.
Wheat	501,912	4,743,000	7.6	605,000	7,078,000	11.7
Oats	190,000	2,783,508	18.	230,000	4,190,000	20.
Rye	48,685	280,431	5.8	46,000	474,000	10.3
Peanuts	195,134	5,980,919	100			
Sweet potatoes	84,740	8,493,203	100	80,000	8,000,000	100
Hay	375,795	369,732[1]	0.98[1]	320,000	419,000[1]	1.31
Tobacco	221,800	138,813[2]	625	250,000	167,000,500[2]	670
Cotton	1,274,404	665,132[3]	234	1,439,000	799,000[3]	239
					(1911)	315

[1]Tons. [2]Pounds. [3]Bales.

	Production per Individual.		
	1860.	1910.	1913.
Corn	30 bu.	15 bu.	22.5 bu.
Wheat	4.7 bu.	1.8 bu.	3.3 bu.
Oats	2.7 bu.	1.2 bu.	1.5 bu.
Tobacco	23 lb.	69 lb.	70 lb.
Sweet potatoes	62 bu.	4 bu.	3.5 bu.
Cotton	⅛ ba.	⅓ ba.	½ ba.

Nineteen hundred and eleven is the last year we have a report as to stock, the Corporation Commission having combined several kinds of animals, and state value of combination in the tax lists. In 1911, compared with 1909, there was a gain, of horses, 4,000; mules, 6,000; milk cows, 3,000; hogs, 33,000; a loss of 7,000 in cattle and 4,000 in sheep.

The crop of 1913, the last of which we have a full report, was as follows:

	Total.	Value.
Corn	55,282,000 bu.*	$ 65,000,000
Oats	4,485,000 bu.*	3,100,000
Wheat	7,078,000 bu.*	8,500,000
Rye	474,000 bu.	474,000
Buckwheat	174,000 bu.	136,000
Potatoes	2,400,000 bu.	1,938,000
Potatoes (sweet)	8,000,000 bu.	4,880,000
Rice	7,000 bu.	9,000
Hay (tons)	419,000	6,914,000
Tobacco (pounds)	167,000,000	31,000,000
Cotton (bales)	800,000	50,000,000
Cotton seed		10,000,000
Peas		1,500,000
Peanuts		6,000,000
Soja beans		100,000
Grass, other seed and green forage		2,000,000
Vegetables (garden)		2,500,000
Apples		2,044,670

*Including forage.

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	Value.
Peaches, pears, and grapes	$ 1,500,000
Truck	2,500,000
Pasturage	30,000,000
Dairy products	2,000,000
Poultry and eggs	9,000,000
Wool	220,000
Farm animals	18,000,000
Total	$259,315,670

If to this is added the crop of animals:

	Value.
425,000 pigs, 74,000 lambs, 3,368 horse colts, 842 mule colts, 1,000,000 hogs butchered, and the year's growth on yearling and young stock which was reported as crop of 1909	$ 18,000,000
The farming lands were valued for 1913 at	232,000,000

The following report as to imports of feeds which could be produced in the State is interesting as showing the inclination of our people to raise their supplies. In 1909 the amount was $59,000,000.

Showing comparative values of food and feed products shipped into North Carolina during 1911 and 1913:

	1911.	1913.
Corn @ 80c. a bushel	$ 4,346,420.80	$ 6,404,672.80
Wheat @ $1 a bushel	4,378,316.00	5,686,647.00
Oats @ 50c. a bushel	119,966.00	173,687.00
Apples @ $5 a barrel	357,105.00	349,650.00
Dried fruit @ 10c. a pound	19,420.30	9,432.30
Cured meat @ 12½c. a pound	6,666,429.62	1,027,102.87
Fresh pork @ 10c. a pound	37,664.30	92,608.90
Barreled pork @ $25 a barrel of 200 pounds	55,875.00	50,900.00
Dressed beef @ 12½c. a pound	12,937.00	7,085.25
Miscellaneous packing-house products @ 10c.	----------	1,307,800.00
Butter @ 20c. a pound	875.20	1,110.40
Cheese @ 12½c. a pound	39,057.37	36,845.37
Canned goods @ $2.50 a case	116,257.50	147,247.50
Sirup @ 40c. a gallon	21,110.80	28,584.80
Honey @ 10c. a pound	789.50	1,068.80
Vegetables @ 5c. a pound	3,516,716.45	6,637.00
Hay @ $20 a ton	15,607,820.00	2,160,940.00
Feedstuffs—bran, shorts, etc., @ $25 a ton	2,225,625.00	1,650,425.00
Total values	$39,640,885.55	$20,716,671.68
Balance in favor of 1913		19,124,213.87

The above figures, most of which were taken direct from the books of the different railroad companies doing an interstate business, seem to be the closest approximation possible to the actual facts, and show that the State has decreased its imports greatly within the last four years and is thus waking to the possibility and necessity of producing its own food supplies.

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DRAINAGE.

There are eighty-three drainage districts being operated in the State, which have probably contributed a quarter of a million acres of new land to this corn crop, which will probably exceed six million bushels in its yield.

The Department has no connection with general drainage law, but conducts, in coöperation with the National Department, *farm* drainage, instructing and demonstrating to the farmers proper systems to suit the farms concerned, both in open ditch and tile drains.

Drainage of the creeks in the piedmont section not only restores thousands of acres of lands of highest quality, but also improves the health of the communities, which have been subject to the most virulent types of fever.

ANIMAL HUSBANDRY.

The following counties have been cleared of ticks and released from quarantine during these two years: Cumberland, Greene, Harnett, Hoke, Lenoir, Moore, New Hanover, Robeson, Scotland, Wayne, and a portion of Northampton.

This has been a great relief to the people of these counties and has enabled them to sell their cattle at an advanced price and with but little trouble. Two years more will probably clear the State wherever the stock law prevails. It will hardly be practical to eradicate the tick where there is the open range.

HOG CHOLERA.

Anti-hog-cholera serum has been distributed in sixty-six of the one hundred counties of the State and at least $100,000 saved the farmers. The price, which was 50 cents per c.c. in 1912, is now 25 cents, and it is expected to fix the price at 20 cents. A suitable plant has been completed at a cost of $9,000. No further appropriation will be requested, unless it be for constructing a road or equipping feed lots. The receipts from sales, it is estimated, will pay the expenses of operation.

Amounts of serum put out in the different counties in the State from December 1, 1913, to November 15, 1914:

Alamance	320 c.c.	Chowan	4,200 c.c.
Anson	599 c.c.	Columbus	1,900 c.c.
Beaufort	39,670 c.c.	Craven	3,950 c.c.
Bertie	16,980 c.c.	Cumberland	3,369 c.c.
Bladen	3,113 c.c.	Davidson	2,960 c.c.
Buncombe	17,132 c.c.	Duplin	2,240 c.c.
Cabarrus	5,070 c.c.	Durham	1,899 c.c.
Caldwell	60 c.c.	Edgecombe	61,214 c.c.
Carteret	11,440 c.c.	Forsyth	295 c.c.
Chatham	83 c.c.	Franklin	5,935 c.c.

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Gaston	2,925 c.c.	Orange	650 c.c.
Gates	1,430 c.c.	Pamlico	3,543 c.c.
Granville	4,050 c.c.	Pender	1,916 c.c.
Greene	1,000 c.c.	Perquimans	3,510 c.c.
Guilford	6,550 c.c.	Pitt	25,788 c.c.
Halifax	27,919 c.c.	Richmond	4,450 c.c.
Harnett	360 c.c.	Robeson	6,555 c.c.
Haywood	1,200 c.c.	Rockingham	1,650 c.c.
Henderson	570 c.c.	Rowan	5,116 c.c.
Hertford	4,240 c.c.	Sampson	1,953 c.c.
Johnston	13,291 c.c.	Scotland	1,671 c.c.
Jones	4,358 c.c.	Stanly	60 c.c.
Lenoir	9,657 c.c.	Stokes	240 c.c.
Lincoln	110 c.c.	Swain	750 c.c.
Martin	750 c.c.	Vance	2,880 c.c.
McDowell	100 c.c.	Union	1,650 c.c.
Mecklenburg	5,261 c.c.	Wake	22,735 c.c.
Moore	22,583 c.c.	Warren	970 c.c.
Nash	3,750 c.c.	Washington	14,654 c.c.
New Hanover	3,006 c.c.	Wayne	12,170 c.c.
Northampton	9,210 c.c.	Wilson	3,270 c.c.
Onslow	32,052 c.c.	Yancey	900 c.c.

There have been some cases of black leg and a few of glanders. These have all been attended to by the Veterinary Department, and there has been no serious outbreak. Careful attention has been given to prevent introduction of the foot and mouth disease now prevailing in some of the States. So far it has not appeared in North Carolina.

Dr. Flowe has fully justified the confidence of the Board in placing him in charge as State Veterinarian. His three years experience was of great value in equipping him for the position.

ANIMAL INDUSTRY.

Professor Gray, as shown by his report, has done considerable work on several lines. The hog work is perhaps the most extensive at this time and most valuable to the State.

The use of the Edgecombe farm for this work has been given him, the superintendent to furnish him the crops he may wish for experiments by raising them on the farm. This work is directly along the lines of the Lever law, and much of the money for conducting it should be received from that source.

The press states that the North Carolina Farmers' Union has requested the Legislature to make a direct appropriation to meet that of the Lever bill. This is proper as an appropriation to the A. and M. College, as the Lever bill does not in any way recognize the State Board of Agriculture; but the funds come as an appropriation to the A. and M. College, and the Department is rather butting in, while there is still abundant opportunity for the Board to spend all its funds in the lines which the State law directs.

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COTTON.

What to do with cotton is the disturbing query in North Carolina economy.

If our farmers followed the advice of the Board this matter would be settled and cotton would be sold or held at their pleasure. They will not do this. Then some legal plan of warehousing is needed. This is a matter for the Legislature which we cannot control. The system which was used for tobacco warehouses, and was among our statutes from 1777 to 1905, seems to be as good if not better than any other proposed, and would require but little change in phraseology. The only relief for the farmer is to raise the supplies necessary to operate his farm.

REDUCTION OF NEXT CROP.

There can be no doubt about this being done in this State, as large crops of wheat and oats have been sown, and some will put cotton land in beans, pease, etc., next spring, while it is thought others will put in tobacco that deducted from cotton, and will in 1915 experience the same loss from excess that is now the lot of the cotton men.

What legal action can or will be taken on this subject is a matter for the Legislature; and as the legislators are fresh from the people, they will decide what shall be done.

The Department has no power to enforce any ideas it may entertain on the subject; and a simple pledge to redeem has not proved of much value in the past, and would not be worth the expense of canvassing to procure them.

GRADING AND STANDARDIZING COTTON.

Last year Congress directed the Department of Agriculture to establish grades of cotton. Nine grades were established, attention being paid only to color and freedom from trash. I called the attention of the National Department to the fact that the true value of cotton was not color and freedom from trash, but length and tensile strength of fiber, and suggested that attention be given to this feature in grading. I also proposed amendments to the bill which Mr. Lever of South Carolina had offered on the subject. The bill was amended as suggested, and these properties are now considered in making standards.

The United States Bureau of Marketing entered upon this service in Edgecombe County, the ginner sending a sample designated by a number from each bale of cotton. This is graded and returned to the ginner, who puts the grade on the bale as numbered. The farmers of Edgecombe inform me that it has been of value, and the grade of the cotton has been higher than heretofore. The price at which Edgecombe grade

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sells is compared with kind of cotton graded in old manner at Stanhope, Fayetteville, and Scotland Neck, to show the difference paid for graded and ungraded cotton.

It is a little singular that in 1914, a hundred and fifty years or more since cotton became a prominent article of commerce, its true value is considered in fixing its market price for the farmer or producer. This matter is always considered as the cotton approaches the miller. In another season it is expected that the work will be much extended, and as it covers the whole South, the National Department should bear the expense.

The United States law as to standards and grades can only apply (as the pure food law does) to interstate business. It will be necessary for the State to enact it so that it will apply to transactions between our own citizens.

ANALYTICAL.

The analysis of fertilizers has continued, and there has been but little complaint as to deficient goods. Where there has been any, the Commissioner has determined the loss or penalty according to the amended law, recognizing shortage in weight as well as in analysis.

The following have been recognized by the Board as legal bases for fertilizer ingredients, and are not required to be analyzed each year: Acid phosphate, Thomas slag, bone meal, kainit, manure salt, muriate of potash, sulphate of potash, nitrate of soda, cyanamid, dried blood, slaughter-house tankage, fish scrap, cotton-seed meal, sulphate of ammonia. All other tankages must be analyzed each year, and all other material to be used as sources.

SOIL WORK.

The following counties have been surveyed and maps have been or will soon be prepared for distribution: Ashe, Randolph, Johnston, Forsyth, Wake, Bladen, Union, Rowan, and Lincoln.

A few years ago it was customary to request of the Department formulas for each kind of crop, and many formulas were prepared and distributed by Bulletin or otherwise. Mr. Worthen, in charge of the soil work, in 1902 called attention to the fact that it was necessary to have some knowledge of the soil as well as the crop to prepare a formula of value. Since that time much advance has been made on this line. A knowledge of the soil is one of the most important items for our farmers.

While the soil survey is progressing each year, the reports of the composition of the soils are not as complete as they are in some other States. It requires a man well versed in this to properly report this subject. I suggest that a Division of Soils be established to cover this whole mat-

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ter, the director of which shall be in charge of the soil survey, soil investigation, soil analysis, and all matters relating to this head, and that all persons engaged in it report to him.

TEST FARMS.

The old tobacco belt or Granville farm at Oxford and the black land at Wenona, Washington County, have been added to those heretofore operated. The Blantyre farm yielded a crop of very fine apples for the first time this year. It was wise to retain this farm, which the Department has managed from clearing the land and which affords opportunity for experiments and demonstrations in fruit.

The apple crop in North Carolina is very abundant; as our apples become better known, fruit growing will be one of the most remunerative businesses in the State. The prominence which it has attained is due largely to the work of the Horticultural and Entomological divisions of the Board.

FOODS AND ILLUMINATING OILS.

This is now a division in charge of Mr. W. M. Allen. There is not much adulteration now found in the goods offered for sale in the State, but it requires constant inspection to maintain the standard which has been established.

BOTANY AND AGRONOMY.

The quality of the seed sold is much improved; and the amount received for licenses has increased from $1,350 in 1913 to $1,675. Tobacco seed cleaned in 1913, 300 acres; in 1914, 43,000 acres.

The Board at the June (1913) session decided to undertake the manufacture of cultures for legume crops, as the Commissioner had recommended two years ago, and authority had been given by the act generally known as the "Brown bill." No work undertaken by the Department has met with a more ready response. Cultures for nearly 8,000 acres were sold in the three months operated, and at 50 cents per acre, while the price had formerly been $2, a saving of $12,000 to the farmers. The demand this spring is expected to be much increased and the sale of the goods to meet all expenses. This was done this fall, and the salary of the assistant and cost of laboratory in addition.

The Agronomist has been permitted, upon application for his services, to visit and make suggestions to persons having large tracts of land or single farms. The persons visited pronounce his services the most valu able they have received; the results are reported to the Department, and the farmers of the State get the advantage of them. Miss Rademacher, the assistant in charge of the manufacture of cultures, is well equipped for work and the Department was very fortunate in securing her services.

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DEMONSTRATION.

Mr. C. R. Hudson of the National Department is in charge of this work, and is now operating in eighty-one counties. The benefit of the work will depend upon the efficiency of the county demonstrators, and it may require some time to procure a sufficient number of capable men for all the positions. This work is done in coöperation with the authorities of each county, and the county can discontinue the work if not deemed profitable. The demonstrator is supposed to be acquainted not only with crop raising, but also animal husbandry and diseases. In 1913 the average among the operators was, for corn, 44½ bushels per acre.

COÖPERATIVE MARKETING.

This is a subject of much importance to the farmer. One farmer often by individual action makes himself unnecessarily a competitor of his neighbor, when by acting in unison the interest of each would be promoted. If the farmers in a community would inaugurate the system, it would be beneficial to them and would grow until different communities would learn to act together. Attention is called to the report of the Chief of Marketing, which contains much information of value.

FARMERS' INSTITUTES.

The progress the farmers have made is due more to this work than to any other of the Department, although all of our activities have been helpful. It has taught them to think and to have the courage of their convictions.

The institutes of the season of 1914 have been more largely attended and greater interest has been manifested than heretofore.

The attendance for 1914 was:

Men	35,632
Women	36,187
Total	71,819

The total attendance for 1913 was 57,805, an increase for 1914 of over 20 per cent. This does not include the Demonstration, Corn Club, Girls' Work, and Dairy meetings.

Prizes are offered for the best loaf of bread by a woman over 20 years of age and best pone of corn bread by a girl under 20. These prizes are limited to women living on a farm.

When feasible, women's branch institutes are organized at the places where institutes are held, to meet monthly. Two hundred and five of these institutes were organized. If the women take hold of this matter

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as we expect, it will in a great measure solve the problem of "rural uplift," as the men will be willing to attend the meetings if the women are there.

Mr. Parker is the president of the American Association of Institute Workers, which includes the United States and Canada.

The work among the girls, generally known as tomato club work, is one of the most important in agricultural history. It is equal to that which has been made by the girls' fathers in handling the principal agricultural crops, and includes not only canning, but pickling, preserving, in such condition that it can be kept for use as desired, of all family supplies which the farm, orchard, or garden produce. The wives and daughters of farmers in the past have had in most cases little consideration as to their comfort or convenience, and but little opportunity to provide themselves with money to be used as they may deem best: allowance is frequently small and grudgingly given.

Too often the birth of a daughter is deemed the arrival of a rather undesirable member of the family, who will be a "help eat" and not a help meet. This is unjust, and many a family comes to wish that each member had been a girl. The result of this work is expected to remedy this injustice and give the girls a chance to show to the world that it was not ability, but opportunity, they lacked in the past.

The Department found in our own midst a person adequately equipped for this work—Mrs. Charles McKimmon of Raleigh—and she has discovered or developed aiders of suitable ability as they were needed.

The Confederate wife, sister, sweetheart, and daughter made the Confederate soldier what he was; and their descendants will make the Southern men as famous and valuable and notable as farmers if they will yield to their influence.

In the thirty counties in which Mrs. McKimmon directed work the girls coöperating derived a personal profit over expenses of $25,000, or $800 to a county. It is hoped next year to operate in nearly every county and to average at least $1,000 to the county.

Four hundred thousand tin cans and 55,000 glass jars were prepared. For all these goods there is a ready market, as they are warranted as to quantity and quality. I hope each one who reads this report will turn to and read Mrs. McKimmon's.

CORN CLUB WORK.

The number of boys enlisting in this work increases each year and the corn crop of the State is increased by their yields. The work is well conducted by Mr. T. E. Browne and his assistant, Mr. Morrison. I have no suggestions to make, but only request them to continue the work in

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the efficient manner in which it has been conducted, and that when the time shall come for the boys to be the farmers they will show by their farming the benefits they received through the efforts of the Department.

EXPIRATION OF TERMS.

The terms of the following members expire March 1, 1915:

K. W. BARNES	Second District.
R. W. SCOTT	Fifth District.
WILLIAM BLEDSOE	Eighth District.

LEGISLATION.

It is recommended that the provision in section 14, chapter 67, Laws of 1911, which requires advance of the funds of the Agricultural Department to pay expenses for surveys of drainage districts be repealed.

That the law concerning weights and measures be enforced.

That the provisions of the National laws as to pure food and grades and standards of cotton be enacted by the Legislature, so that the provisions of these acts will apply to citizens of the State when dealing with each other.

Also, if necessary, the Board be given power to exempt from annual analysis.

BULLETINS.

The Bulletins issued by the Department rank with the best from any source, including the National Department. The bulletin on canning having been exhausted, a new edition was issued for the month of October.

The reports of the heads of divisions in the Department force, and a financial one of the receipts and expenditures for the years 1913 and 1914, are annexed.

THE NORTH CAROLINA FARMER.

Much is said about the large per cent of illiterates among the adult farmers of the State, which is much to be regretted, and all efforts should be encouraged to correct it; yet this report is of the work accomplished by the North Carolina adult farmer. As the adult farmer of the Confederate period, who was reported equally as ignorant, proved himself the equal of any of his comrades as a soldier, so the North Carolina adult farmer of today is leading in the agricultural advancement of the country. It would seem that the North Carolina people, although not as far advanced in education as those of most other States, are in no way behind in performing the duties of their day and generation. An ignorant man in North Carolina seems to be at least the equal of the

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more fortunate farmers as far as education is concerned in the other States, and is surpassing them in practical results of his labor.

It is a great pleasure to make this report of the work of the Department. It is the equal of any ever made by a State in same length of time, and an earnest of what may be expected in the future. The farmers and their families have taken hold of the work with vim and sought intelligence as to how to increase their crops, preserve their lands, and lighten their labors.

With thanks to a kind Providence for His many blessings to us as a people and prayers for the continuance of His mercies,

Respectfully,

W. A. GRAHAM,

Commissioner of Agriculture.

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REPORT OF STATE CHEMIST AND DIRECTOR OF TEST FARMS.

Report is herewith made on the several lines of work committed to my charge during the past two years (December 1, 1912, to December 1, 1914).

ANALYTICAL.

The number of analyses made of the various materials during the two years is shown in the summary below:

Official samples of fertilizers	3,723
Fertilizers and fertilizer materials for farmers	805
Cotton-seed meal	758
Mineral waters	86
Marls, limes, lime rock, and feldspar	171
Rocks, ores, and minerals identified and values reported	198
Concentrated stock feeds examined chemically and microscopically	694
Soils	400
Total for two years	6,835

The amount of work represented by these analyses is large and the results have been of great service to the farming interests of the State. There has been a great increase in the analyses of limestones, marls, and other lime products for agricultural use. Careful attention has been given to the analysis of these products and to the location of deposits in the State which could be developed in a commercial way.

Analyses of the soils of the State have been continued as heretofore in connection with the soil survey, and much valuable information has been obtained in this way. A considerable number of these analyses have already been published and others are in form for publication.

The Legislature made two changes in the fertilizer law. The first requires the guarantee of water-soluble nitrogen, which includes nitrogen from nitrate of soda, sulphate of ammonia, and small amounts from animal and vegetable sources. These represent the quick-acting nitrogen used in fertilizers. The second change allows the manufacturer to guarantee potash as sulphate when he desires credit for potash in this form in tobacco goods. This change was especially for the benefit of the tobacco grower. The information included in both these changes has been obtained in our analyses for a number of years and has been published in our fertilizer Bulletins, the amendments to the law merely requiring a guarantee of data obtained heretofore in our laboratory and presented in our publications. Water-soluble nitrogen is readily available for plants and is quick-acting. In addition to these determinations, we have been making determinations of the availability of the other

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nitrogen in fertilizers. These two taken together furnish a good idea of the quality of the nitrogen-furnishing materials in fertilizers.

The work on fertilizers and other materials than feeds is performed by Messrs. W. G. Haywood, J. Q. Jackson, E. S. Dewar, E. B. Hart, and J. R. Mullen.

FEEDS.

The inspection and analysis of stock feeds and condimental feeds and medicines have gone on in the usual way and with satisfactory results. The results of the two years work have been published in the November and October Bulletins respectively. These Bulletins contain the findings of the microscopic and chemical analyses, together with such comments as seemed desirable and such information as was thought would be of interest and value to the feeder. Interest in the inspection of feeds is increasing and the amount of correspondence in connection with the work grows yearly. Definitions for practically all of the common feeds and mixtures sold on the market have been made in connection with the Association of Feed Control Officials and have been adopted by the Board, along with such regulations as have been found desirable in connection with the trade with feeds.

Taken as a whole, there has been a marked improvement in the quality of feeds sold in the State since the inauguration of the Feed Law, and buyers of feeds are now getting products of good quality and what they are represented to be.

The feed work is done by Dr. J. M. Pickel and Messrs. J. Q. Jackson and E. S. Dewar.

SOIL WORK.

The soil survey work is conducted in coöperation with the Bureau of Soils of the United States Department of Agriculture, each institution furnishing three men for this service, and in addition Mr. W. E. Hearn, of the Bureau of Soils, has given a large amount of time to the soil work in the State. During the two years soil maps have been completed of Ashe, Randolph, Johnston, Forsyth, Wake, Bladen, Union, Rowan, and Lincoln counties.

Soil analyses, both chemical and microscopical, have been continued in the laboratory of samples collected in the soil survey work, as well as of those gotten for special purposes or sent in by farmers and others.

A Technical Bulletin has been published giving the results of studies of the minerals in our different soils which supply phosphoric acid, potash, and lime. These mineral studies, with the aid of our field results, are enabling us to know just what minerals in our soils are furnishing available plant food, and are forming the basis of what we hope to be a quick laboratory method for the examination of soils and recommendations for specific fertilization for best results.

Fertilizer and other experiments with soils on the Test Farms and on a large number of the main-type soils at other points in the State have

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been continued and enlarged to cover new soil types, as they have been found in the soil survey work. A number of bulletins have been published giving these results, among which are "Results of Fertilizer Experiments with Cotton on the Edgecombe Test Farm," "A Preliminary Report on the Mountain Soils of the State," and two reports prepared but not published covering respectively the analyses of the soils of the piedmont and coastal plain sections of the State.

In the period covered by this report all the soil work of this Department and of the Experiment Station has been joined together and is being conducted as one undertaking in a very agreeable and satisfactory way. It is in charge of Mr. C. B. Williams, who is reporting in detail during the time it has been under his direction.

TEST FARMS.

The farms were established primarily for the conduct of experiments to obtain new data in regard to farm crops, soils, fertilizers, horticulture, live stock, etc., which would be of benefit to the agriculture of the several sections in which the farms are located. Their chief benefits are coming from these new facts, but they are also proving of great interest and value because of the general operations on them. Work has progressed very satisfactorily on the farms during the last two years. The number of visitors from near by and from a distance is yearly increasing.

The bringing together during the last two years of all the experimental and demonstration work of the National and State Departments of Agriculture and of the Agricultural College has put the farms at the disposal of all these institutions for the conduct of their work in the State. The workers in all of these institutions use these farms of the Department and the Experiment Station farm and other facilities of the several institutions for their various lines of endeavor. I shall therefore only cover the more general work and conditions on the farms and call attention to the reports of Mr. Hutt in Horticulture, Mr. Sherman in Entomology, Mr. Williams in Agronomy, and Mr. Gray in Animal Industry, for more detailed reports in their several lines.

Edgecombe Farm.—The general and experimental work on this farm is with fertilizer, variety, culture, and other tests with corn, cotton, peanuts, oats, bur and crimson clovers, vetch, and pecans, and work with hogs and sheep. The tests with sheep are new and were begun in the spring of this year with a limited number obtained in Pender County and are being continued this fall with a car-load from the mountains. The amount of grazing furnished by the volunteer crops of vetch and bur clover is being determined, the grazing being supplemented by known amounts of concentrated feeds. Heretofore this farm has been used almost entirely for work with the field crops generally grown in the section. Plans have been made by which a larger portion of the farm—

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in fact, practically all of it which is not now in use for work with field crops—will be devoted to studies of Animal Industry problems, mainly with hogs and sheep. The effects of peanuts, soy beans, and other eastern crops on the quality of pork are to be worked on and means for overcoming the injurious effects are to have attention. The lowland to the back of the farm has been tile drained.

Pender Farm.—A great deal of work has been done in clearing, stumping, draining with tile and open ditches in getting this farm in condition for experimental and other uses. Enough land is almost prepared now to meet our needs for some time in the future. Permanent pasture of Bermuda and bur clover has been started to give grazing for the dairy cattle and the hogs. The coöperative work with the United States Department of Agriculture with Scuppernong grapes has been enlarged and is progressing satisfactorily. Other important work in progress on the farm is with the dairy, cheese-making, pecans, testing of summer apples suited to the section, varieties of sweet potatoes, methods of keeping sweet potatoes, grazing and other crops for hogs to determine the cost of pork production and the quality of pork, the feeding of beef cattle with and without shelter, etc.

Black Land Farm.—This farm consists of 200 acres and is located immediately on the Norfolk and Southern Railway, at the station of Wenona, about midway between Mackeys Ferry and Belhaven. The farm is a good representative of the black or muck soils of the State, of which there are between 2,500,000 and 3,000,000 acres in the State. These lands are very rich and highly productive, but there are many difficulties connected with the successful handling of them for various crops. This farm is to be used in the study of questions peculiar to this character of land. Large canals have been put in for draining the area as a whole, and they are working satisfactorily. Reasonably good progress has been made on this farm and in an economical way, when conditions are considered. About 100 acres have been cleared and gotten into crops this year, mainly corn. This area has been fenced, two good houses, one for ordinary labor and another somewhat better for the use of the foreman, have been constructed. A deep well has been put down and lateral ditches dug, in part, for draining the cleared land, these ditches being carried into the large canals. A beginning has been made in putting tile in the open ditches, and it is proposed to tile drain practically all of the farm under cultivation as it can be reached.

Iredell Farm.—The experimental and other work with corn, the grains, cotton, fruits, and other crops and their best fertilization, methods of cultivation and handling, is not only in good condition, but attractive and is finding a wide usefulness because of the large area of red clay and red-clay loam soils in the State. The farm is increasing in productiveness and the appearance of the farm is pleasing. The horse-breeding work is continuing to prove useful and popular. We now have six head

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of pure-bred Percherons on the farm, three colts, and three mature animals. Cost record is being kept in the raising of the colts. Beef-feeding work is being continued, and plans have been carefully worked out for studying a number of the important questions relating to beef production for that section. A bulletin has been published giving the results of the beef feeding during the past winter. An additional area of the land set aside for pasture has been seeded to grass for the work with horses and hogs. A flock of 100 or more hens is being maintained on the place under farm conditions and records of cost and income are being kept. Some additions have been added to the poultry houses and equipment to meet the needs of this work. The experiments with fruits are proving satisfactory and are giving good financial returns.

Buncombe Farm.—Practically all of the land which has been in process of clearing has been gotten either into crops or grass for pasture during the year. Good crops have been produced on the farm and its productiveness is being increased by the growth of soil-improving crops, especially crimson clover. The old orchard has produced good crops of apples, and a considerable additional planting of apples of the main standard varieties which are thought best suited to the section has been made. A few of a number of kinds of nut-bearing trees have been put out in line with similar tests on the other farms. The experimental work with fertilizers, varieties, culture, and other tests with corn, the grains, grasses, Irish potatoes, cabbage, and fruits are being continued as heretofore. Progress has been made in the construction of the dairy barn, in accordance with the plans to inaugurate dairy work on this farm to study dairy problems as related to the section.

Transylvania Farm.—Roads have been constructed in the mountain orchard so that the trees can be reached for spraying economically and for gathering the fruit. This orchard is now coming into bearing and important results are indicated, especially in the tests of the various varieties of apples which have been planted in the orchard. Valuable data is being collected in the orchard relating to thermal belts or air drainage. The other usual work on the farm is being continued.

Granville Farm.—The Granville or old bright tobacco belt farm has already attracted wide attention and is very popular in the section. A large amount of carefully planned experimental work with tobacco, corn, the grains and grasses is in progress, and the results already obtained, especially with tobacco, are interesting and valuable and are having their effect on the tobacco industry of the section. This farm is conducted in coöperation with the United States Department of Agriculture, which contributes liberally toward the expenses and joins in working out the plans of the experimental work. The coöperation has been of the most valuable and agreeable nature. Some additional land has been cleared and drained during the year, a good dwelling has been completed for the superintendent, and a modern water system installed, two tobacco barns

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and a pack-house for tobacco and a laborers' house have been constructed. The old orchard has been pruned, sprayed, and cultivated and has produced a good crop of fruit.

The heads of the several divisions of the Department and Experiment Station plan and conduct, in consultation with the director and assistant director, their lines of work on the several farms. They are encouraged and given every opportunity to make their efforts strong and applicable to the needs of the farming interests of the several sections in which the farms are located.

In addition to the names already mentioned, Mr. H. R. Fulton in Plant Diseases and Mr. Z. P. Metcalf in Entomology are conducting work on the farms on their special subjects.

Mr. R. W. Collett, as assistant director for all of the farms, gives all of his time to them. The assistant directors living on the farms are as follows:

Edgecombe Farm	F. N. McDOWELL.
Pender Farm	J. H. JEFFERIES.
Iredell Farm	F. T. MEACHAM.
Buncombe Farm	F. S. PUCKETT.
Granville Farm	E. G. MOSS.

Exhibits have been made at the State Fair and a number of the county fairs of the work on the farms.

DRAINAGE.

Interest has grown in the drainage work, which has progressed very satisfactorily. This is carried on in coöperation with the Office of Experiment Stations of the United States Department of Agriculture, which furnishes the services and expenses of a drainage engineer, and this Department an assistant and his expenses. The work is largely confined to farm drainage with tile and to terracing: the former to remove surplus water from within the soil and the latter to take away water in such a way as to prevent erosion.

Mr. H. M. Lynde represents the United States Department of Agriculture and Mr. F. R. Baker this Department in the drainage work.

EXPERIMENTAL AND EXTENSION WORK IN AGRICULTURE JOINTLY CONDUCTED.

The State and National Departments of Agriculture and the College of Agriculture and Mechanic Arts together conduct the work of the Experiment Station and Extension Service, the former embracing all experimental or investigational work in agriculture and the latter including demonstration, all club work, and other services of an extension nature out in the State. The National Department of Agriculture exercises its functions in connection with the joint work through its

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officials, by conferences and written agreements, while the two State institutions deal with it through the joint committee for agricultural work, made up of members of the two boards and legalized in chapter 68 of the Laws of the General Assembly of 1913, as follows:

The General Assembly of North Carolina do enact:

SECTION 1. That there is hereby authorized and legalized a joint committee to be known as the "Joint Committee for Agricultural Work"; that this committee shall be composed of four members of each of the boards of agriculture and the trustees of the North Carolina College of Agriculture and Mechanic Arts; and in addition thereto the Commissioner of Agriculture and the president of the North Carolina College of Agriculture and Mechanic Arts be *ex officio* members of said committee.

SEC. 2. That the four members of the joint committee from each of the two boards shall be designated by the board of which they are members respectively, and shall serve on the committee during their terms as members of the board, unless excused from such service by their respective boards. The members already designated by the two boards for service on this committee shall continue to serve during their terms as board members.

SEC. 3. That for the purpose of preventing duplication and friction and for increasing efficiency in agricultural work in the State the joint committee for agricultural work heretofore provided for shall have supervision and control of such agricultural work of the same kind or kinds as both the Department of Agriculture of the State and the North Carolina College of Agriculture and Mechanic Arts are conducting or may conduct under authority of law, together with any work which either of these institutions may agree to place under the joint committee, and especially shall this joint committee have supervision and control of all experimental and investigational work in agriculture in the State.

SEC. 4. The joint committee shall use funds as may be designated by law or which may be placed at its disposal by each of the two boards or by any benefactions in the conduct of the work outlined in section 3 of this report. It shall determine and employ such workers as may be necessary for the conduct of the work and regulate their salaries and duties. All actions of the joint committee shall be subject to the approval of the Board of Agriculture and the board of trustees of the North Carolina College of Agriculture and Mechanic Arts.

SEC. 5. This act shall be in force from and after its ratification.

This act was ratified March 7, 1913.

The agreements for the joint conduct of all the agricultural work in the State of the same or similar kinds have been worked out voluntarily by the institutions having to do with them at a number of conferences of the boards, committees, and officers, beginning on May 23, 1911, and extending to June 5, 1912, at which time a definite plan for the organization of the work was finally adopted and put into operation, the agreement to do this having been reached on January 24, 1912.

The joint work is supported from funds of the State Department of Agriculture, made available by appropriations of the Board, the special appropriations of Congress through the College of Agriculture and Mechanic Arts for the Experiment Station (Hatch and Adams funds),

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and the Extension Service (Smith-Lever funds), appropriations or donations from counties and allotment from the funds of the National Department of Agriculture for work in this State under a number of specific agreements.

Much time and careful thought has been given to working out well considered plans for the various undertakings. These plans have been presented from time to time to the joint committee and to the two boards and are being carried out by the workers in an agreeable and thorough way.

The joint work is stronger than coöperation. It is in reality a union of the efforts of the State and National Departments of Agriculture and the College of Agriculture and Mechanic Arts, each having its share in the planning and control of the work and having, consequently, a corresponding interest and responsibility for the results. This union of forces has not only added strength to the efforts for the betterment of farming in the State, but is pleasing to the workers, because of the desirable relations in which they are placed toward each other and the agricultural work in the State as a whole and to the institutions having to do with it.

Respectfully submitted,

B. W. KILGORE,
State Chemist and Director.

RALEIGH, December 1, 1914.

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REPORT OF CURATOR OF THE MUSEUM.

HON. W. A. GRAHAM,
Commissioner of Agriculture.

DEAR SIR:—Herewith I beg to submit my report as Curator of the Museum for 1913 and 1914.

In this institution, as in all others of a similar character, a large part of the time of the force employed is taken up with work that is more or less routine in character. Correspondence, filing, label writing, cataloguing and general office work constitute one side of this, the other dealing mainly with the care and repair of specimens and attention to visitors.

The preparation of specimens, their arrangement and display, and the preparation of cases for their reception, constitute another line of work, this being very variable in volume, depending, as it does, on the receipt of new material and on the consummation of plans for increasing the exhibits in the Museum from material already on hand.

In the period under discussion the routine and general work have been conducted efficiently. These lines, as I have said before, take up a large percentage of our time and, while necessary and constant, no direct results are seen therefrom in the exhibition rooms. But deterioration in the exhibits would quickly be evident were this work neglected.

ADDITIONS.

The additions to the Museum display series during the past two years have been mainly in the line of agriculture, this being particularly the case during the last half of the period. This has been partly due to the fact that the Board instructed that the Museum should be made more agricultural in character, and partly to conditions that made it possible to largely increase our agricultural exhibits by special collections made for the San Francisco Exposition, our participation in which was finally abandoned.

In addition to the large series of grains and grasses secured in this way, the Museum force has made and installed a number of agricultural and horticultural models. These include model orchards, showing correct and incorrect methods of planting; models of square and diagonal methods of setting out trees; of apple orchard with peach-tree fillers. A tenth-acre tomato patch is also shown, made to scale and with the 342 plants in place, as advocated for tomato club work by those in charge thereof.

In glass jars we show nuts, canned fruits and vegetables, and grain samples. A cream separator and other dairy appliances are exhibited, the former to be shortly connected up so as to be shown in operation.

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Other models are being made, such as a properly laid out farm, a field with tile drainage installed, etc.

In the department of Geology we have secured an additional series of building stones, of North Carolina brick, and of minerals.

An interesting addition in the Forestry room is a cypress section, 5 feet in smallest diameter, which was cut 20 feet above the ground. This three was 11 feet 1 inch across the stump. The section referred to will be dressed and polished, the annual rings counted, and the face marked to show the size of the tree at various notable periods of American history.

In the Zoological department we have prepared a number of cases of specimens arranged in natural surroundings, some of which are artificially lighted. These add much to the attractiveness and educational value of the exhibit.

STATE AND OTHER FAIRS.

The Department has continued to follow its established custom of exhibiting at the State Fair and at various local fairs, with the idea of bringing before the people of the State the various lines of work it is conducting for the benefit of the farmer. The making of these exhibits at the State Fair has been under my charge, as before, and I cannot but feel that the annual exhibit made there has been of benefit both to the Department and to many of the visitors viewing it. Some of the exhibits at local fairs have also been under the writer's direction, and I consider this to be a good and useful line of work.

SAN FRANCISCO EXPOSITION.

At its June meeting the Board of Agriculture made an appropriation of $15,000 towards a North Carolina exhibit of the agricultural resources of the State at the San Francisco Exposition. This appropriation was provisional on the Commission appointed by the Governor raising $50,000 additional, with $2,000 of the Board's appropriation immediately available for collecting and preparing agricultural specimens then being harvested. A fine collection of grains was made, both threshed and in the sheaf, and this was prepared for exhibition. The writer, meanwhile, had been appointed by the Governor as executive commissioner for North Carolina, with instructions to take full charge of the making of the State's exhibit at the Exposition, should one finally be made. The whole matter fell through, however, for lack of funds, and the material collected has since been used both in the Museum and at other exhibits made by the Department.

HISTORICAL COLLECTION.

The historical material formerly exhibited in the Museum has been transferred to the Hall of History, in the State Administration building. This has given us room for expansion that was much needed,

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although the almost complete rearrangement that the change called for required a great deal of time and labor to complete satisfactorily. But the improvement in other lines that resulted therefrom is fully worth the outlay.

ATTENDANCE.

The great number of visitors to the Museum in the course of a year attest its popularity. The attendance is estimated at more than 100,000 annually. A high-water mark was reached on Thursday of Fair Week in 1913, when 8,085 visitors were *counted* entering the Museum doors.

GENERAL.

Considering the other lines of work handled by the Museum Division, such as superintending repairs and rearrangements in the building, exposition work, making exhibits at fairs, etc., I consider that the improvement and advancement of the Museum in the past two years have been eminently satisfactory; and plans are on foot for a greater advancement in the future.

The Museum is an educational institution, working on broad lines. It teaches by the eye. Selected specimens are exhibited, each accompanied by a descriptive label, and it is safe to say that every visitor going through the rooms leaves the place with some items of knowledge added to his store. We make no attempt to show objects that are mere freaks or curiosities. Everything we exhibit has educational value of some kind, and I fully believe that our State Museum is filling a valuable place in the educational system of the State.

Respectfully submitted, H. H. BRIMLEY,
Curator.

RALEIGH, December 1, 1914.

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REPORT OF THE VETERINARY DIVISION.

To the Commissioner of Agriculture.

SIR:—I have the honor to transmit herewith the biennial report of the Veterinary Division, covering the period from December 1, 1912, to December 1, 1914. The work until September 1, 1913, was under the direction of Dr. W. G. Chrisman.

Respectfully submitted, B. B. FLOWE,
State Veterinarian.

TICK ERADICATION WORK.

Tick eradication has been carried on in coöperation with the United States Bureau of Animal Industry in a very satisfactory way. The work has been prosecuted in the following counties: Moore, Hoke, Robeson, Scotland, New Hanover, Greene, and a portion of Northampton, and farm-to-farm inspection work is now being conducted in Cumberland County.

Moore, Hoke, New Hanover, Robeson, and Scotland counties have been freed from ticks and are now ready to be released. These counties comprise 2,627 square miles. I recommend that they be released from quarantine.

For the coming year work will be conducted in Greene, Cumberland, and a portion of Northampton counties. Work will be begun in Harnett County in the early spring. The counties in which the work will be conducted during the coming year are the counties which have recently adopted the no-fence law. We realize that it will require more time and work to eradicate ticks from these counties than it would in counties in which the stock law has been in operation for some years, and for this reason we think it advisable to keep several of the inspectors on during the winter months. With this in view, I recommend that two of the inspectors be continued during the entire year.

During the extraordinary session of the General Assembly seven counties adopted the no-fence law, and we have received a good many requests from people in these counties to begin the tick eradication work as soon as possible. The law becomes operative in these counties in March, 1914, and I am informed that the United States Bureau of Animal Industry will increase their working force in this State in proportion to any increase made by the Department. In order to begin work in these counties, I think it advisable that our field force be increased so that the work may be pushed forward as fast as possible.

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GLANDERS.

We have received a good many reports of glanders in various parts of the State, but upon investigation we have found that a large majority of the cases reported was not glanders. However, we have found a number of isolated cases, and in each instance the diseased animal or animals have been destroyed, properly disposed of, and a thorough disinfection made of the quarters in which they were kept, and the suspicious animals were held under quarantine for further investigation. In most instances where glanders has been found the animal or animals were owned by people who were not able to lose them, and as there is no way in which the owner can be reimbursed for the loss of a horse or a mule affected with glanders, they will not report the disease, and in the majority of the cases it is just by chance that we hear of it at all. I believe if some way could be arranged whereby owners could be partially reimbursed for their loss, that they would be more apt to report the suspicious cases, instead of trying to conceal them, as a great many of them now do.

BLACK LEG.

Black leg is an infectious disease of cattle, usually affecting those between the ages of 6 and 18 months. However, cattle younger or older than this are not entirely immune, but it is very seldom that we see one affected with black leg.

Black leg is a preventable disease, and I believe if the young cattle were systematically immune that it would not require a great while to completely eradicate this disease from the State.

The United States Bureau of Animal Industry will furnish, free, black leg vaccine, if in return they are furnished with a complete record of all the vaccine used. This disease seems to be confined entirely to our mountain counties, as we have not received a single report of a case in the eastern part of the State.

TUBERCULOSIS.

Tuberculin testing has been practically discontinued for the past two years. However, we have continued testing herds owned by the different State institutions; also other large herds in which we had previously found infection. At present the herds at the different State institutions are comparatively free from tuberculosis.

We are constantly receiving requests from dairymen in different parts of the State to assist them in freeing their herds from tuberculosis, but we have been unable to do this, owing to a lack of sufficient help. The dairymen all over the State seem to be very much interested in freeing their herd from tuberculosis. There is only a very small per cent of native cattle affected, but we realize that if even one infected cow is allowed to remain in a herd it will not be a great while until a large

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per cent of that herd will be affected with tuberculosis. In order to do away with what few tubercular cows there are in some of our herds before tuberculosis has gained any appreciable headway, I recommend that this work be resumed within the near future.

HOG CHOLERA.

Hog cholera is distributed over a greater portion of the entire State. We have had outbreaks in nearly every county in the State. However, we find the largest per cent of cholera in the eastern and western counties where they have free range. It is estimated that the annual loss of hogs from cholera is approximately $750,000.

ANTI-HOG-CHOLERA SERUM PLANT.

The General Assembly of 1913 transferred from the State Penitentiary to the North Carolina Department of Agriculture and the State Board of Health a small tract of land lying on the south side of Raleigh, to be used for the purpose of manufacturing anti-hog-cholera serum, diphtheria antitoxin, and other sera. By an agreement reached between Dr. A. C. Shore, director of the State Laboratory of Hygiene, and Dr. W. G. Chrisman, who was then State Veterinarian, it was agreed that the Department take for its portion of this tract that lying on the south side of Walnut Creek, and the State Board of Health that which lies on the north side.

In the spring we began the erection of a new serum plant on that portion of the land accepted by Dr. Chrisman for the Department. This plant was completed about the first of September at a cost of approximately $5,800. The plant consists of a laboratory building, which is divided into a bleeding room, blood room, and general laboratory; also a hog house which is sufficiently large to accommodate about seventy hogs. Both the laboratory and hog house have sewerage connection which empties into a large cement reservoir in which the sewage is thoroughly disinfected before being turned into the stream.

We believe, so far as the buildings are concerned, that we are as well fitted to produce anti-hog-cholera serum as any Southern State, but we have been unable to properly equip the plant owing to a lack of sufficient funds.

ANTI-HOG-CHOLERA SERUM.

The manufacture and distribution of anti-hog-cholera serum by this Division has continued to increase. From December, 1912, till November 15, 1913, we have produced 242,512 cubic centimeters, and the receipts from the serum plant since the first of June, 1912, to November 15, 1913, have amounted to $2,449.22. We have on hand now about 26,500 cubic centimeters, which is worth $395.

We are sending this serum direct to the farmers with instructions as to how it should be used. We realize that better results would be obtained if the serum was being used by qualified veterinarians, but as

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there are so few veterinarians in the State, it would make it too expensive to furnish only veterinarians with this serum, as the farmers would have to pay the veterinarian's fee and traveling expenses for a considerable distance. However, the farmers are reporting, in almost every instance where the serum has been used, splendid results, thus showing they can use the serum, with directions furnished them, very satisfactorily.

We have been charging 1½ cents per cubic centimeter for the serum. We believe, however, that this can be, eventually, reduced to 1¼ cents per cubic centimeter.

So far the "serum alone method" only has been used. We do not think it advisable to furnish an inexperienced farmer the virus with which to make the simultaneous injection. Of course, if this could be done it would make it much cheaper for the ones using the serum, as it would confer permanent immunity; whereas the "serum alone" treatment only immunizes them for a period of from four to six weeks. There is considerable danger attached to the simultaneous method. Even when it is used by a veterinarian who has had experience in applying it, the loss is anywhere from 1 to 5 per cent of the hogs treated. In several of the large herds where we have applied this method we have had very satisfactory results, and the owners are highly pleased in having their herd permanently immune from cholera.

I would like very much to see the Department furnish a man to do more of this work, as it would mean a great deal to the farmers, and if carried on extensively enough it would tend towards the eradication of cholera. In using the "serum alone method" we are not making any headway at all in the eradication of cholera, as it only checks the disease in individual herds for a short time, and often the immunity of the serum has worn off before the premises have been rid of the infection.

In the process of manufacturing anti-hog-cholera serum a large number of hogs are required. This is true because we are unable to grow the virus in the laboratory. This makes it necessary that we secure all virus from hogs affected with cholera. The blood is taken from the hogs that are in the last stages of an acute form of cholera, defibernated and injected into permanently immune or hyperimmune hogs. These hogs are bled and from this blood the serum is prepared. We are often unable to secure the proper size hogs, or hogs of any kind at a reasonable price. We sometimes have to pay as much as 10 cents per pound live weight. This makes the cost of producing this serum greater than would be the case if we could secure hogs at a less cost. Believing that we could raise our hogs cheaper than 10 cents per pound, I would like very much to have sufficient funds to put a fence around the land at the serum plant, which is about 40 acres, and also funds to repair an old dwelling which is on the ground, so as to be able to put a man in this house to live so that he could attend to the hogs and help with the work in general at the serum plant. It would cost about $1,500 to do this.

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INTERSTATE SHIPMENTS OF LIVE STOCK.

Nearly all of the States are now requiring a health certificate on all domestic animals for interstate shipments. This certificate has to be issued by a qualified veterinarian and a duplicate copy attached to the bill of lading before the shipment will be accepted by the railroad companies. This necessarily works a hardship on a great many of our people located in the western part of the State, as the nearest qualified veterinarian is located in Hickory. The people around Asheville and the extreme western part of the State are forced to call a veterinarian from Spartanburg, S. C., pay his fee and traveling expenses in order to have their animals properly inspected for an interstate shipment.

To relieve our stockmen of this great inconvenience and expense, I would like very much to see an assistant State Veterinarian located somewhere in the western part of the State. I believe he could find ample work to keep him busy, and that we would be able to render more valuable service by having some one located in that section. This man could assist in applying the black leg vaccine, the tuberculin test for interstate shipments, assist in the hog cholera work, and make other investigations which we are called upon to do.

INVESTIGATIONS.

This Division has made investigations at a number of places that have reported infectious trouble. Sometimes we found the trouble as reported; then, again, it was entirely of a local nature.

FARMERS' INSTITUTE WORK.

This Division has had a representative with one of the farmers' institute parties.

COUNTY FAIRS.

We have assisted in the live-stock work at a large number of the county fairs and have found a general improvement in the quality of the stock exhibited.

LIVE STOCK AND COLT SHOWS.

We assisted in judging at a colt show held at Mooresville, and I was very much pleased with the high grade of colts shown. We also assisted in the stock show held in Watauga County. We are sorry to say that, owing to this being a one-day show, and a continuous rain on the day set for the show, there were very few animals exhibited, and these were out for a short time only, most of them reaching the grounds about 12 o'clock and were removed as soon as the premiums were awarded. I do not believe the people in a community receive the benefits they should from a one-day fair, and this is especially so if it is a bad day and the animals are placed on exhibition for a short time only. With this in view, I recommend that State aid be discontinued for one-day fairs.

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LIVE STOCK.

The reports from the beef and dairy bulls show that they are in good condition, and that the people in the communities in which they are located are very much pleased with them. We have received a number of applications for more of these bulls.

REPORT OF VETERINARY DIVISION FOR YEAR DECEMBER 1, 1913, TO DECEMBER 1, 1914.

TICK ERADICATION WORK.

Tick eradication has been carried on in coöperation with the Bureau of Animal Industry of the United States Department of Agriculture in a most satisfactory way.

During the past year the work was conducted in Cumberland, Wayne, Greene, Lenoir, Harnett, and a portion of Northampton counties. A farm-to-farm inspection is now being conducted in Bladen County.

During December, 1913, and January and February of 1914 an educational campaign was conducted in these counties in order to arouse interest in the work and to show the methods of eradicating ticks. This was done by talks, illustrated lectures, and demonstrations. We believe this is, in a large measure, responsible for the splendid results that have been obtained in the counties where tick eradication work has been conducted. I wish to state that the counties in which the work has been conducted have coöperated with us in every way possible.

The county commissioners of Lenoir County provided sufficient funds to employ three local inspectors to assist in the work. The commissioners of Wayne County also provided funds for two local inspectors for the entire season, and later on in the season added the third man. The commissioners of Harnett County also provided funds for the employment of two local inspectors. These men have been of a great deal of service to us in the tick eradication work. In fact, if it had not been for the aid given by the counties it would have been impossible for us to have cleaned up as much territory as was cleaned during the past season.

During December, 1913, and January, 1914, a number of violations were located along the Wake-Johnston and Wake-Harnett County lines. In every instance the parties, or party, violating the quarantine regulations pleaded guilty and paid a small fine and costs.

Cumberland, Wayne, Greene, Lenoir, and Harnett counties have been freed from the Southern cattle tick and are now ready to be released. These counties comprise 2,125 square miles. I, therefore, recommend that they be released from quarantine.

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During December, 1914, and January and February, 1915, an educational campaign, similar to the one conducted during the past season, will be conducted in Johnston, Duplin, Sampson, Pender, and Bladen counties.

I might say here that the county commissioners of Bladen County have already employed two local men to assist in this work during the coming spring. I believe the counties in which the work will be taken up next spring will do likewise. This is the first time since the tick eradication work was begun in North Carolina, with the exception of Henderson County, that the county commissioners have given any financial assistance in this work.

GLANDERS.

A large number of supposed cases of glanders have been reported to us during the last twelve months. In most instances a large per cent of the cases have proven to be some condition other than glanders. We have located glanders in only three different sections of the State. In each instance the animal or animals were properly tested and the reactors destroyed and buried, the barns in which they were confined properly disinfected, and all exposed animals tested. .

In my annual report of 1913 I recommended that some way be provided whereby owners losing horses with glanders could be reimbursed or partially reimbursed. I again make this recommendation.

BLACK LEG.

There has been an unusual amount of black leg in cattle in the western part of the State during the past summer, and we have supplied the cattle owners with a large amount of black leg vaccine, administering some of the black leg vaccine ourselves.

In Clay County, where an outbreak occurred, it seems that the infection was brought across the mountains from the State of Georgia by the buzzards. At least, this was the only source to which we were able to attribute the infection.

TUBERCULOSIS.

About 1,000 head of cattle have been tested for tuberculosis during the year; 700 head were tested in Henderson County with only three reacting to the test. These are now under quarantine and will probably be disposed of during the coming winter.

The herds belonging to the State institutions have been retested, and we now feel that these herds are practically free from tuberculosis.

We are constantly receiving requests from dairymen over the State to assist them in freeing their herd from tuberculosis. We have been unable to respond to all the applications, owing to a lack of sufficient help. The dairymen all seem to be very much interested in freeing their herds from tuberculosis.

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There is only a small per cent of native cattle affected with tuberculosis. This was shown by the large number of cattle tested in Henderson County. Most of these cattle were native cattle, and the few that reacted were ones purchased from large dairies.

HOG CHOLERA.

Hog cholera is distributed over a greater portion of the entire State. We have had outbreaks of it in nearly every county, with the exception of a few counties in the piedmont section. We have found the largest per cent of cholera in the eastern part of the State where free range is still in use.

Dr. F. D. Owen, a representative of the United States Department of Agriculture, has been assigned to duty in this State to assist us in conducting a demonstrative and educational campaign against hog cholera. This work consists in going into counties, holding meetings to demonstrate the use of anti-hog-cholera serum, disinfecting premises, and giving illustrated lectures. This work so far has been conducted in Edgecombe and Beaufort counties. It will be taken up in Nash and Craven counties, as these counties have already provided sufficient funds to pay for the serum that will be used in giving demonstrations. This representative has also spent several weeks with one of the farmers' institute parties.

ANTI-HOG-CHOLERA SERUM.

We have treated a great many hogs in the State with anti-hog-cholera serum, and have also treated a large number with the simultaneous treatment, with highly gratifying results. The per cent of hogs saved in infected herds and in herds that have been exposed to hog cholera would indicate that a large number of hogs have been saved by the serum that otherwise would have died, thereby causing considerable loss to their owners. We have also sent a large amount of the serum direct to the farmers, and from their reports they are highly pleased with the results obtained from its use.

We have not yet begun distributing hog cholera virus with the serum for the simultaneous treatment, but arrangements are being made so that the laity in any section of the State, who so desire, can visit the serum plant to become familiar with the technique used in the simultaneous method. After they have spent enough time at the plant to become thoroughly familiar with this method of immunization a permit will be issued them, and in the future hog cholera virus will be furnished them with which to make the simultaneous or permanent immunization.

There has been a considerable increase in the amount of serum put out this year over that of last year. From December, 1912, to November 15, 1913, 242,512 cubic centimeters were produced. From November 15, 1913, to November 15, 1914, 616,285 cubic centimeters of serum were produced. The receipts from the serum during this period have

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amounted to $7,408.77, leaving 125,180 cubic centimeters on hand. At 1¼ cents per cubic centimeter this is worth $1,564.75. We have at the plant at this time 267 hogs, approximately valued at $2,800.35.

This year we got out a bulletin on hog cholera and its prevention by the use of anti-hog-cholera serum, and also a hog cholera poster showing the methods employed for eradicating and controlling hog cholera. These posters were distributed over the State in the different counties, being posted in the depots, on courthouses, country stores, postoffices, and other conspicuous places where they would attract attention.

Until July 1, 1914, the charge for the serum was 1½ cents per cubic centimeter. At this date the cost was reduced to 1¼ cents per cubic centimeter. It will be noted that the serum has been reduced since 1910, when the work was first begun, from 2½ cents per cubic centimeter to 1¼ cents per cubic centimeter.

SERUM PLANT.

A good many improvements have been made at the serum plant during the year. Twelve acres of the land transferred from the Penitentiary Board to the Agricultural Board has been fenced in. Sterilizers, a refrigerator and hyperimmunizing crates have been added. A small building is now under construction which will be used exclusively for handling virus. This is in accordance with the standard set by the United States Department of Agriculture.

The old house which is on the place has been remodeled and is now in condition to put some one in who will be at the plant constantly. We would have placed a man there before this time if we had been able to get a desirable man at a price we could afford to pay. We hope to find such a man very soon.

After spending a considerable amount of money in drilling a well, we finally had to abandon it (owing to not being able to reach water) and lay a line of pipe from the city main, connecting at the city abattoir, which is approximately 2,000 feet away.

We believe now the serum plant is on such basis that it will take care of itself, and will not require any further appropriation from the Department to maintain and operate it.

FARMERS' INSTITUTE WORK.

This Division has furnished a representative for a number of the farmers' institute meetings.

INVESTIGATIONS.

The Veterinary Division has also made investigations at a number of places that have reported infectious trouble. In some instances we have found the trouble as reported, and in others the conditions found were entirely of a local nature.

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COUNTY FAIRS.

We have assisted in live-stock judging at a number of the county fairs. I am glad to report, as I did last year, that we found a general improvement in the quality of the live stock exhibited.

LIVE STOCK.

Reports from the beef and dairy bulls show that they are in good condition, and that they have been the means of greatly improving the quality of the live stock in their communities.

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REPORT OF ANIMAL INDUSTRY DIVISION.

MAJOR W. A. GRAHAM,
Commissioner of Agriculture,
Raleigh, N. C.

MY DEAR SIR:—As I was not familiar with the fact that I was expected at this time to send you a report covering two years work, I overlooked this phase of your letter until a day or so ago. As the Animal Industry Division has been organized as at present for a little more than a year, the report I am submitting can very well answer both purposes.

It is manifestly impossible for me to give in a report of this kind a detailed statement of all the lines of work carried on by the Animal Industry Division during the past year. The items here presented showing the progress in many of the leading projects will, however, serve to show the scope of the work undertaken.

This report covers the work done since the December (1913) meeting of the State Board of Agriculture.

SWINE.

THE VALUE OF RAPE AND OAT PASTURES FOR FATTENING HOGS.

Last fall a bunch of pigs, which were grown upon the Pender Test Farm, was divided into two equal lots, one being fattened on oat pastures, while the other was grazed on rape. Each lot was fed, in addition to the pastures, some waste corn and skim-milk. These pigs grazed from February 2 to April 27, when they were butchered and sold on the Wilmington market. During this time it cost $5.95 and $5.84 respectively to make 100 pounds of pork on the oat and rape pastures; or, in other words, each bushel of waste corn was sold, by means of the pigs, on the oat pasture for 76½ cents, while each bushel on the rape pasture brought 86 cents. Or, stating it in still another way, the skim-milk was marketed by means of the pigs on the oat pasture for 68.6 cents per hundredweight, while the same amount of skim-milk in the rape lot was sold for 73.4 cents. The pigs were sold for $7.65 per hundredweight.

This test serves to emphasize the point that hogs can be fattened in the coastal section of the State very cheaply on green pasture during the winter months.

VALUE OF WASTE PEANUTS FOR HOGS.

There is absolutely no doubt but that peanut growing is destined to become a very great business in North Carolina, especially in the coastal and sandy regions. Peanut growers are all perfectly familiar with the fact that it is impossible to get all the nuts out of the ground and market them commercially. Knowing this to be true, we thought that it would be an excellent idea to study the question of utilizing these waste nuts;

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so last fall we made arrangements with Mr. Holderness of Tarboro, who is an extensive grower of peanuts, to carry on a feeding experiment with him to determine just how much pork could be made on a definite area of waste peanuts. As the result of this arrangement with Mr. Holderness 250 pigs were purchased in Tennessee and shipped to his farm and turned onto a peanut patch of approximately 140 acres; the nuts, or as many of them as could be obtained, had been marketed commercially, and the hogs were expected to clean up only the waste. The 250 pigs were turned into the field October 7 and found sufficient feed for rapid growth until December 18, a period of 72 days. During the 72 days each pig gained 83 pounds, or a total of 20,750 pounds, which was made as a result of grazing the waste peanuts. This test conclusively shows that the peanut grower who does not utilize the waste by means of pigs throws away from $6 to $10 worth of feed per acre. Mr. Holderness paid 8½ cents per pound for these pigs in Tennessee, shipped them to Tarboro, inoculated every one of them, fed corn in the hardening period at 91 cents a bushel, and finally shipped them to Richmond, Va., where they were sold for $8.35 per hundredweight. On the whole transaction $843.71 was made, or probably as much as was made on the commercial crop of peanuts.

PROFITS REALIZED ON A SMALL HERD OF HOGS.

A year ago last September we began keeping an exact record of a small herd of hogs on the Pender Test Farm in order that we might finally be in position to make more intelligent recommendations about growing feeds for feeding hogs in that section of the State. The experiment was begun with five sows and one boar. During the year, September 1, 1913, to September 1, 1914, a profit of $48.96 was made on this small herd when corn, which was raised on the farm, was charged against them at 70 cents a bushel, wheat bran at $26 a ton, skim-milk at 40 cents per hundredweight, waste potatoes at 25 cents a bushel, and temporary pastures at $5 an acre. These results were not wholly satisfactory. After the work is better organized we hope to be able to handle the herd with greater profits.

COST TO RAISE PIGS TO THE WEANING AGE.

This study is being made on both the Pender and the Iredell Test Farms. The work at the Pender Test Farm was inaugurated something more than a year ago, and some definite results are being secured. The work at the Iredell Farm was inaugurated in April of this year; consequently, we have nothing to report at that test farm as yet.

There has really been no careful study made to determine the cost of raising pigs from birth to weaning age, notwithstanding the fact that this is probably the most critical period of the pig's life. At the Pender Test Farm we have now accurate information on the cost of raising six

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different litters. When the feeds are valued as indicated above, it cost from $1.01 to $1.97 to raise each pig to the weaning period; we have practiced weaning them when about 70 days old. This work will bring before the farmer in a concrete shape the importance of having prolific sows, as the cost of each pig is determined largely by the number of brothers and sisters he has.

FEEDING COTTON-SEED MEAL TO PIGS.

This experiment is being carried forward in coöperation with the Chemistry Division. We feel that we are getting results which will be of untold value to both the cotton producers and the hog producers of the South. We feel sure that copperas tends to partly, if not completely, eliminate the danger when cotton-seed meal is fed to hogs. We expect, however, to continue this work on a practical and commercial basis until we are thoroughly satisfied and are in position to make recommendations to the farmers of the State.

FIELD WORK WITH MATURE FARMERS.

Last winter we inaugurated with the mature farmers of the State what we call a Home-made Meat Club. The main object of this organization is to induce the farmers, who have not been doing so, to raise their own meat. On account of the lack of time, no special campaign has been made to secure membership, but something like 600 grown farmers of the State are now members of this club and are growing crops for hogs and feeding hogs under our general directions. We do not have sufficient force nor funds to visit the members of this club, so we must be content with sending out circular-letters and bulletins giving general instead of specific information. I feel that the farmers of the State appreciate this move, and I hope that the Division may soon be placed in a position where the work can be looked after more carefully and pushed with greater vigor.

BEEF CATTLE.

Since the June meeting of the Board plans have been perfected with Washington whereby two new men are to devote all of their time to field work with beef cattle. The Department of Agriculture, Washington, D. C., is to bear practically all of the expense of this work. These two men are to work with the beef cattle farmers and assist them in every possible way. They will visit individual farmers, advise with them about breeding and feeding, buy breeding and feeding cattle for them, and make public addresses. We feel that this is a distinct gain to our organization, as Mr. Curtis and Mr. Shook have had very much more work to do than they could possibly attend to in a satisfactory manner. The addition of these two men makes it possible for the beef cattle field work to be enlarged very materially.

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BEEF CATTLE FIELD WORK.

During the year a large amount of general field work has been done by Mr. Curtis and Mr. Shook. They have visited many farmers and been the means of getting several new beef farms inaugurated. Fifteen herds of beef-breeding cattle have been selected in various parts of the State for the purpose of keeping accurate records on the cost and methods of producing beef. This work, of course, is being done in coöperation with farmers. The herds have been selected in various sections of the State, so an opportunity is given of studying the cost of growing beef cattle in the three sections of the State. Within a few years these records can be placed before our beef cattle farmers and will be of great value to them.

During the year Mr. Curtis has placed with farmers throughout the State about 150 head of grade heifers for breeding purposes, as well as a number of pure-bred bulls. As much attention has not been given to this kind of work as is needed, but with the addition of the two new field men it is hoped that many more farmers may receive direct assistance of this kind.

Feeders of the piedmont and coastal sections of the State do not, as a rule, understand how to buy and how to ship cattle from the mountains. When, therefore, the Animal Industry Division offered to act as an agent for the purchase of feeding cattle a very hearty response followed. Last winter approximately 1,000 head of feeding cattle were purchased in the western part of the State, and shipped to these feeders. Mr. Curtis and Mr. Shook at regular intervals visited the farmers where these cattle were sent, advised the owners as to how the cattle should be fed and handled, found them satisfactory markets in March and April, and attended to shipping the cattle to these markets. The results of this work have been reported in a circular-letter. On the whole, the results were very satisfactory, and the work is being duplicated this year—on a smaller scale, however, as the high price of feeding cattle discouraged some of the feeders from purchasing. This character of work can be very greatly enlarged since the addition of the two new field men.

THE MOST PROFITABLE AMOUNT OF COTTON-SEED MEAL TO FEED WITH HULLS AND SILAGE.

Seventy-six cattle, divided into eight lots, were fed in this experiment. Four of these lots were fed cotton-seed meal and the other four corn silage. The amount of cotton-seed meal varied from 6 pounds to 10½ pounds a day. This test is being duplicated again this winter, so we do not feel justified in giving out definite reports as yet, but some very striking results have already been secured, showing the advantage of corn silage as a roughage feed when it is desired to place cattle in high

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market condition. Our eastern markets—and that is where we most naturally expect to sell our good beef cattle—are constantly demanding higher finished animals, and it seems that corn silage offers a solution to this very pressing Southern problem. It was learned that the large amounts of cotton-seed meal could not safely be fed long enough to get the steers in marketable condition when fed in conjunction with hulls, but when fed in combination with silage no ill results were manifest.

THE RELATIVE VALUE OF CORN SILAGE AND COTTON-SEED HULLS FOR FATTENING CATTLE.

This work was done at the Iredell Test Farm, and the results are already published in the August Bulletin from the Department of Agriculture. Forty-eight steers were fed, 24 of them being fed on cotton-seed meal plus cotton-seed hulls, while the other 24 were fed on cotton-seed hulls and corn silage. They were fed 120 days, and during this time the gains were practically the same in each lot, but when they were placed on the market the silage-fed cattle sold at a premium of 20 cents per hundredweight and were fed at slightly more profit than the hulls-fed cattle. This work is being duplicated this winter and 48 steers have been delivered at the farm for this purpose. Satisfactory profits were made on both lots.

SHOULD BEEF CATTLE BE SHELTERED WHEN BEING FATTENED?

Last winter this problem was studied in coöperation with Mr. R. A. Derby, a farmer of Jackson Springs. This winter the same problem is being studied with a car-load of cattle on the Pender Test Farm and also in coöperation with Mr. Derby. In some sections of the State it is a very difficult and expensive thing to secure the proper kind and amount of bedding when beef cattle are fattened in barns or sheds. In fact, if the item of bedding could be eliminated, we feel that there would be a rapid increase in the number of beef cattle fed in the coastal region of the State, where barnyard manures are very badly needed. Last winter, therefore, Mr. Curtis visited Mr. Derby and arranged to feed 16 head of steers in a barn lot in comparison with 16 steers fed the same ration, but under a shed. These cattle were all fed cotton-seed meal and silage. To many men the results were somewhat startling, as the steers which were fed outside made gains approximately 33⅓ per cent faster and were equally as good in finish as the cattle which were fed in the shed and which had an expensive item of bedding and hauling manure charged against them. Mr. Derby was so enthusiastic about outside feeding that some difficulty was experienced in inducing him to feed any animals under shelter this winter, as by outside feeding he saves the expense of hauling both bedding and manure. The results of this work have been published in a circular-letter.

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CAN CORN BE PROFITABLY MADE A PART OF BEEF CATTLE RATIONS?

Many beef cattle projects are being studied on the farm of Mr. T. L. Gwyn of Haywood County. This work, as I stated in my last report, is all being done in coöperation with the Bureau of Animal Industry at Washington, D. C., and a trained man, Mr. Peden, of Wilkes County, lives on the farm and has immediate charge of the experimental work.

Many inquiries come to our office asking if it would not be profitable to use corn in a ration when steers are being fattened. As this question had never been carefully studied, we thought it would be advisable to study it on Mr. Gwyn's farm, so last winter a car-load of cattle was divided into two lots, one lot being fed a ration of 5 pounds of cotton-seed meal, 5 pounds of frosted ear corn, cotton-seed hulls, hay, and stover; while the other lot was fed 7 pounds of cotton-seed meal, cotton-seed hulls, hay, and stover. These cattle were fed 130 days, and the results showed that the corn-fed cattle obtained a finish worth about 10 to 15 cents a pound more than the cotton-seed meal-fed cattle. The cost of the corn, however, overcame the value added as a result of the increased finish; so while all of the steers returned satisfactory profits, still the ones which did not receive corn finally made a profit of 75 cents more than those which ate corn. This work is also being duplicated this winter on a larger scale.

WINTERING STOCK CATTLE.

One of the greatest problems that the beef cattle raiser must face is the question of getting his young stock through the winter in a satisfactory and cheap manner. As this question has really not been carefully studied, the farmer has been at sea to know just what to expect. Plans are made to study this question in a thorough and comprehensive manner on Mr. Gwyn's farm. Last winter 85 head of stockers, divided into four lots, were fed in various ways during the cold months. Lot 1 was fed ear corn, cut hay, and stover; lot 2 was fed corn silage and corn stover; lot 3 was fed corn silage and corn stover; lot 4 was fed on nothing but a pasture which had been allowed to grow up the previous summer (88 cents worth of hay was fed each one of these steers during a snowy period). The results of this work show that it cost $8.24 to winter each steer in lot 1; $6.37 in lot 2; $6.12 in lot 3; and only $4.88 in lot 4, which was the lot on winter pasture alone. At the same time the steers which were carried through the winter on winter pasture alone made better gains than those which were fed on high-priced feeds. It can, of course, be seen that these results are of very great importance to the cattle producers of the mountain section of North Carolina.

FATTENING CATTLE ON MOUNTAIN PASTURES.

When spring came the above stockers were turned onto summer pastures, some of them being fattened on pastures and cotton-seed cake, while others were fattened on pasture alone. The two lots of 25 steers

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each received a small amount of cotton-seed cake along with the pasture. They were sold on September 1 to Asheville butchers at $7.50 per hundredweight on the farm. The 35 cattle which had received no cotton-seed cake during the pasture season were sold at prices ranging from $7 to $7.25 per hundredweight. On account, probably, of the abnormally high price of feeders in comparison with the price of fat cattle, it did not pay to supplement the pasture with cotton-seed cake this last summer. Three experienced buyers, however, placed values on the lots of cattle, and stated that under normal conditions the cake-fed cattle would have sold for $1 to $1.25 more than the grass-fed cattle. Several phases of this work have been reported in circular-letters. Before the work is reported as a whole, three or four years work must be done. Plans have already been made for a continuation of the work next summer.

SHIPPING YARDS.

It became necessary to provide better shipping facilities for shipping cattle from the mountains to other sections of the State. So Mr. Curtis, in coöperation with the officers of the Beef Cattle Feeders' and Breeders' Association and the authorities of the Southern Railway, has constructed complete stock pens at Clyde, N. C. These pens are modern, have feed troughs, racks, watering troughs, and scales. During September and October a competent man was placed in charge of these yards to grade and weigh all cattle shipped to farmers who purchased them through the aid of this Division. Weights were secured on other cattle also, there being no less than 2,000 head of steers weighed.

It seemed necessary to get this shrinkage information to avoid misunderstandings between the farmers in the mountains, who raise the cattle, and the feeders who finish them. Much information has been collected on the shrinkage sustained between the farm and Clyde, N. C., and between Clyde, N. C., and the final destination of the cattle.

SHEEP.

THE ECONOMY AND GENERAL EFFECT OF COTTON-SEED MEAL ON EWES.

This experimental work is being done on the Central Test Farm, at Raleigh, and consists of 50 head of sheep divided into various lots. The ewes are fed various amounts of cotton-seed meal to determine whether or not this meal has an injurious effect on the breeding functions of the mothers. So far, the experiments show that there is no danger whatever in feeding rather liberal amounts of cotton-seed meal to breeding ewes. The lambs have been born in perfectly healthy condition, but there is some indication that cotton-seed meal causes earlier lambing. This problem is receiving further attention on a more extensive scale.

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FATTENING EWES AND THEIR LAMBS ON EARLY SPRING PASTURES.

This experiment was carried on at the Edgecombe Test Farm. The farmers who live in the coastal region can easily have winter and early spring grazing pastures; those who live in the mountain sections are deprived of this very great opportunity. It was thought that it would be a good thing to study the question of bringing ewes and their lambs from the mountains to the coastal section and fatten them on cheap grazing pastures. These ewes and their lambs were fattened on the bur clover pastures on the Edgecombe Farm; of course, they were given a small grain ration in addition. These sheep, both the mothers and the lambs, did well, and although the ewes and the lambs cost only $2.40 at the beginning of the test, they were sold upon the local market for $8 a pair.

After the sheep were sold and the lambs were marketed it was found that a profit of $50, or approximately 100 per cent, was made on the original investment. This work is being duplicated this winter and spring with a higher grade of sheep and on a somewhat larger scale.

VALUE OF BARBADO SHEEP IN OVERCOMING THE RAVAGES OF THE STOMACH WORM AND INCREASING THE PROLIFICACY OF NATIVE EWES.

The Barbado sheep have been brought into this country lately from the Barbado Islands. It is known that these sheep are extremely prolific, and it is thought by some that they are partly immune to the stomach worm, the disease which causes very heavy losses in our Southern flocks of sheep. The Animal Industry Division secured a number of Barbado lambs in the spring, and studies are being made to determine whether they are resistant in any degree to the stomach worm. On account of their prolificacy we are also crossing some Merino and Shropshire rams on some of the Barbado ewes, trying to develop a strain of sheep which can be induced to breed earlier in the spring and drop a greater number of lambs. Mr. Curtis expects to get some results from this breeding work which will be of great value to the sheep farmers of North Carolina.

DAIRY FIELD WORK.

At the last meeting of the Board we reported that we had been able to make arrangements with Washington whereby two men would be added to the Dairy field force. These men are now at work assisting Mr. Reed. We have been fortunate in securing the services of Mr. F. R. Farnham, who is an expert in cheese, and Mr. J. A. Arey of Iredell County.

BUILDING WORK.

The farmers of the State have made a very great demand upon Mr. Reed to assist them in building silos. In fact, the demand was so great that with our present force it was impossible to handle the work in the

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old way, so Mr. Hudson very kindly agreed to coöperate with us in this matter. Mr. Hudson directed twelve county agents to meet with Mr. Reed and Mr. Combs at Greensboro, where they were given detailed instructions in building various types of silos. Four days were spent in building silos near Greensboro, and at the end of this time the twelve county agents were thoroughly competent to take charge of the silo work in their various counties. When this plan is carried out to completion we can very easily take care of the silo work. From 75 to 100 silos were erected during the summer months.

The farmers of the State have also been very liberal in calling for plans for dairy barns. Twenty-five dairymen have been assisted by visits and plans and at this time 8 barns and 3 milk houses have been completed, and there are others under way.

To assist in the work of building barns and silos, small models of a dairy barn and the various types of silos were constructed. The main object of making these small models was to put them in the hands of the county agents where they could be displayed in local stores, banks, etc. It is pleasing to state that the county agents have manifested very great interest in these models. The models have also been used at a number of State and county fairs.

COW-TESTING ASSOCIATIONS.

In February and March a cow-testing association was organized in the vicinity of Greensboro and Winston-Salem. This was the first cow-testing association perfected in the South. About 400 cows were secured, the farmers paying Mr. Seitz, the tester, $1 per cow per year. Mr. Seitz works under Mr. Reed's directions. His business it is to visit the members of the association, test the milk, and give general dairy advice. On account of the fact that the farmers themselves are paying for Mr. Seitz' services, each one is personally interested in all his efforts. This association has been in operation only a few months, but between forty and fifty unprofitable cows have been eliminated from the herds, and good cows have been brought in. Some of the herds at the beginning of this testing work were producing butter fat at 40 to 45 cents a pound; as a result of belonging to the association and making a close study of the individual cows, two or three of the herds have reduced this cost to 20 and 25 cents a pound. The dairymen in the vicinity of Greensboro and Winston-Salem appreciate this work and are supporting it well.

A similar attempt was made in Hendersonville and Buncombe counties, and an association was organized the first of June. We are compelled to report that the work in this territory has been a complete failure, as the majority of the farmers failed to take sufficient interest to keep the records, send them in to the office, and pay their quarterly dues. It is hoped, however, that the farmers in this locality may become interested again some time in the near future.

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DAIRY SCHOOLS.

Last winter an effort was made to introduce an entirely new feature into our dairy extension work, a feature that had never been tried in any of the States. An effort was made to introduce real and earnest school work among the dairy farmers and in some of the rural schools. Three types of schools were planned. One-day schools were held in localities where dairying had not become a strong feature of the farming system, the main object being to arouse interest in dairying. In other localities where interest in dairying had already been aroused, three-day schools were introduced; in these schools an effort was made to give solid instruction along dairy and allied lines. The third type of school was carried on in coöperation with a number of country schools, the object being to reach the children and also their parents. Several of the country school authorities were glad for Mr. Reed and his workers to visit them once a month, giving them a day each month to present dairying and allied subjects to the children and visiting parents. Last winter ten one-day schools, four three-day schools, and two coöperative schools were conducted. The same plans are laid for carrying on the same kind of work this winter, and requests for the work far exceed our capacity. The plans have definitely been made for fifteen one-day schools, three two-day schools, ten three-day schools, and ten five-day schools. If we had had more workers in the Division many more schools could have been arranged for.

CREAMERY WORK.

The majority of the managers of the various creameries have been induced to meet together several times and discuss general creamery problems. They met in October, January, March, and July. Some of the creameries have been helped very materially by these meetings, and the managers have come to understand each other's problems. Mr. Reed and Mr. Combs have worked with some of the creameries, and one in particular found that the butter contained a very low percentage of moisture. This manager was taught how to incorporate more moisture into the butter, and he now states that this teaching was worth to him no less than $90 the first month. Another creamery had been operating at a loss from the time of its organization until the authorities were finally induced to make butter by the method recommended. Since the introduction of the new system they are extremely well pleased, as they are now able to report some profit.

About a year ago many requests came to the office to assist in building a creamery in Iredell County, as the people there felt they were ready to erect one. After meeting with the people of the county and also the demonstration agent, Mr. Arey, it was thought best to develop cream routes first and build a creamery afterwards. This system of development was adopted and the cream was shipped to the Catawba

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County Creamery. About 1,000 pounds of butter fat was sent the first month. Within a year this amount increased to 10,000 pounds, and the people were ready for a creamery of their own. The outbreak of the European war checked the building of the creamery for some weeks, but the farmers have now taken hold with new life and the creamery will be in full operation within a short time.

In the southern part of Alamance County, near Liberty, a private creamery was started something over a year ago and finally grew to the capacity of 1,200 pounds of butter a month. This private creamery was first installed out in the country, and the business became too large to operate so far away from town advantages, so a company was organized at Greensboro to take over the work and supply a cream market for Guilford and surrounding counties. This creamery was completed and began operating April 1. Within a very few months this creamery was making 10,000 pounds of butter a month.

During the summer no little amount of difficulty has been encountered in disposing of the butter manufactured by some of the creameries. The output from this State is more than double that of the previous year, and the markets and the buying public will yet think of North Carolina as a butter producing State. It seems, in view of the fact that the dairy and creamery business are sure to develop with remarkable rapidity in the very near future, that it would be an excellent idea for the State Board of Agriculture to employ some one to look after the marketing of dairy and other animal products. This could be done coöperatively by the Divisions of Marketing and Animal Industry. As North Carolina is not at present thought of as a dairy State, we have the problem before us of teaching the people of the South that they must look to North Carolina for butter. This problem should be undertaken in a broad, systematic way; but it cannot be undertaken unless either the Animal Industry Division or the Market Division is given extra help.

Since the outbreak of the European war and the depreciation in the price of cotton, the State has again become infested with the creamery promoter. Mr. Reed has been compelled to devote considerable time to discouraging the building of creameries where the promoters have been active and where creameries could not possibly be operated at a profit. To overcome the activities of the creamery promoter and lessen his field of activity, plans are made for one of the dairy field men to devote practically all of his time to looking after communities and developing cream routes where dairying is first being introduced.

CHEESE WORK.

As the members of the Board know, plans were made at the last meeting to add a cheese expert to the force of dairy field work. Much difficulty, however, was experienced in securing a man competent to carry on this line of work. Finally Mr. Farnham was secured and began work

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September 1. Mr. Farnham has already been active in introducing the work into the upper part of the State. He has given a number of cheese-making demonstrations at various farms and schools and is meeting with more encouragement than we really expected. The farmers appreciate the opportunity offered, and we believe that they will take to the work very readily. Of course, the work has not proceeded far enough to make definite reports.

DAIRY EXPERIMENTAL WORK.

Practically all of the work in dairy experimentation has been carried on by Mr. Eaton at the Pender Test Farm. Some phases of the work have been very materially interrupted by an outbreak of contagious abortion in the herd. The first signs of the disease were found in August, 1913. Since that time the increase in the number of calves has been almost nothing and the yield of milk has been lessened. We hope, however, to have this outbreak under control within another year and have the herd again under normal conditions.

COST OF RAISING DAIRY CALVES.

No question interests the dairyman more than that of raising his dairy calves. Many farmers of the South claim they can buy calves cheaper than they can raise them. Others claim they can raise them very much cheaper than they can buy them. Many breeders of the North are also looking to the South as a place where calves can be raised cheaply and finally transferred to Northern dairies. All of our dairy farmers are interested in the question of the cost of raising dairy calves under Southern conditions, and this study was undertaken to provide definite information.

This particular test was inaugurated June 10, 1913, and accurate records have been kept of the expense of feeding eight Jersey calves. Since June 10, 1913, these calves have made average daily gains of .89 of a pound and it has cost 8.9 cents daily to feed each one. The calves have been fed upon whole milk, skim-milk, green roughage, and pasture. When the pastures of the Pender Test Farm are developed the cost of feeding the calves will be materially reduced.

VALUE OF SILAGE AS COMPARED WITH DRY ROUGHAGES, FOR FEEDING MILK COWS.

Last fall ten cows on the Pender Test Farm were selected for this experiment and five of them were fed upon a grain ration plus silage and stover; the other five were fed upon a similar concentrated ration plus hulls and stover. The experiment was inaugurated November 4 and continued for four months. During this time the silage-fed cows produced 6,397 pounds of milk, while the hulls-fed cattle produced 6,449 pounds of milk. It should be said, however, that the silage was very poor in quality. The silage-fed cattle during the progress of the test ate $88.67

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worth of feed, while the hulls-fed cattle ate $98.07. It, therefore, cost 51 cents a month more to feed each cow in the dry lot than in the silage lot, while the amount of milk produced was practically the same. This experiment is being duplicated this winter.

WINTER RATIONS FOR YOUNG JERSEY CALVES.

One of the weakest points in the whole system of Southern dairying is the question of winter feeding of dairy calves. The majority of dairy farmers neglect their calves during the cold months, and those who do feed them are at a loss to know what Southern feeds are the most economical and most satisfactory. These problems are being studied at the Pender Test Farm, and it is hoped to study them very much more carefully as soon as we have checked the ravages of contagious abortion. Last winter, on December 11, 1913, the calves on hand were divided into two lots, one lot being fed on a ration of cotton-seed meal, silage, and stover, the other lot being fed a ration of cotton-seed meal, wheat bran, silage, and stover, the object being to determine the value of the introduction of a high-priced feed, as wheat bran, into a ration of cotton-seed meal. These calves were fed from December 11 to April 1. It was found that it cost $5.63 to winter each calf in the lot where wheat bran made up a part of the grain ration and $5.53 in the lot where cotton-seed meal was the sole concentrate. No effort was made to produce gain. The calves in the lot where the cotton-seed meal was used alone came through to spring looking very much better, as far as life and oily hair were concerned, than those which were fed bran in addition to the cotton-seed meal. This work is also being duplicated this winter, but the work last winter seems to indicate that nothing is gained by introducing a high-priced feed, as bran, into a calf's ration.

FEEDING DAIRY CALVES THROUGH THE SPRING AND SUMMER.

The above calves were used in the summer feeding work. The pastures have not been satisfactorily developed at the Pender Test Farm as yet. This is a very common weakness on the part of the dairy farms of the State, especially where dairying has recently been introduced. When this condition exists on any dairy farm it becomes immediately a very serious problem as to the best way to handle the calves during the summer months. Of course, where pastures are abundant the calves are taken care of without any thought. To obtain summer growth on the calves at the Pender Test Farm, and on many other dairy farms, it is necessary to feed some concentrate. Mr. Eaton, therefore, has been studying this question also. The calves were divided into two lots and one of the lots fed cotton-seed meal alone, while the other was fed a ration made up of one-half cotton-seed meal and one-half wheat bran. In the lot where bran was used it cost $9.89 to feed each calf from April 1 to October 1, and in the lot where cotton-seed meal was used as the

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sole concentrate it cost only $9.60 to feed each calf the same length of time. At the same time each calf in the cotton-seed meal lot gained 11½ pounds more than the ones in the wheat bran lot. In short, both the summer and winter experiments tend to show that nothing is gained by the introduction of wheat bran.

CHEESE MANUFACTURE.

A 50-gallon cheese vat with the press and complete cheese-making outfit has been installed at the Pender Test Farm. Mr. Eaton is first making a careful study of the proper method of making Cheddar cheese under conditions as they exist in the coastal region of this State. Since August 1 he has made 118 pounds of green cheese from 991 pounds of milk. These cheeses are being carefully studied as to flavor and quality and as to the best proper ripening temperature. Some of the cheeses are being kept in a small refrigerator while some are being ripened at ordinary room temperatures. This work is to continue during the following year.

Mr. Eaton is also making a careful study of various methods of making and putting on the market cottage cheese. Since June 1, 435 pounds of cottage cheese have been made from 3,532 pounds of skim-milk. Investigations are being made also in the marketing of this product. Some of this cheese has been sent to the Raleigh market and given to a dealer to determine the demand for this kind of product; some has been sold to Mr. A. O. McEachern, who has a market for a peculiar kind of cottage cheese at Wilmington.

'ONION FLAVOR INVESTIGATIONS.

The dairymen who live in the piedmont and coastal regions of the State suffer very great losses during certain periods of the year with onion flavors. Mr. Eaton is studying the question of onion flavors at the Pender Test Farm. So far his time has been devoted largely to the question of determining just how quickly flavors are taken up by the milk after onions have been eaten, and just how long these flavors last. Since the work was started in June, 566 samples of milk have been examined as to flavor. These samples are drawn at regular intervals from ten minutes to four and a half hours. It is generally thought that molasses feeds tend to overcome the flavor of onions, and it has been found on the Pender Test Farm that molasses feeds seem to weaken onion flavor considerably, but do not entirely eliminate the objectionable feature.

BOYS' AND GIRLS' POULTRY CLUBS.

As the members of the Board will remember, provision was made at the December meeting of the Board to inaugurate boys' and girls' poultry club work in this State. We were able to begin the work January

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20, 1914, with Mr. Ross in charge. The poultry club work has the same general objects in view as have the corn clubs, except that in the poultry clubs an effort is being made to get the boys and girls of the State acquainted with animal life instead of plant life. It was not deemed advisable to try to cover the whole State the first year; so certain counties, where active local agents were employed, were selected for the first year's work. During the spring and summer the counties of Anson, Catawba, Iredell, Mecklenburg, and Wake have been organized, and at present there is a total membership of 350 boys and girls. Some of the counties have been exceedingly active, while some of them have been somewhat indifferent. The poultry breeders of the State have assisted very materially in the work, in that they are willing to sell members of the poultry clubs hatching eggs at reduced prices. This spring the members of the clubs have hatched over 4,000 chicks; 1,000 of these chickens are worth not less than $1.50 each, the remaining being worth perhaps 50 cents each, thus making a total of over $2,500 worth of stock raised as a result of the efforts of the members of the poultry clubs. Some of the members have also built new poultry houses.

The work will be developed by enlisting the interest of other county agents, ladies in charge of the tomato clubs, public school teachers, and other people and organizations who can act as leaders. Work will be introduced into several new counties this winter and spring. The old counties will not be neglected, although the agents in the old counties are sufficiently experienced to carry on the work with very little assistance from the State agent.

PIG CLUB WORK.

The members of the Board will also remember that arrangements were made at the June meeting to introduce what is known as pig club work among the boys of North Carolina. Girls are not excluded from membership; in fact, in some States the enrollment of girls is large. This work is done in coöperation with the Bureau of Animal Industry, and we were fortunate in securing the services of J. D. McVean. Mr. McVean did not report for duty until August 24, 1914, so really nothing has been done except outlining the plan of campaign. The following counties have been selected as the territory in which the work of organization is to be started: Anson, Beaufort, Craven, Cumberland, Forsyth, Guilford, Mecklenburg, Randolph, Stanly, and Wilkes. Iredell may also be organized this year. In order not to disappoint boys and girls in any part of the State who may want to join the club, an opportunity is provided for them to come into the organization of clubs under a miscellaneous group. This work will all be done in coöperation with the members of the demonstration force, public school teachers, and with all

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other individuals who can be induced to be leaders. Mr. McVean is very well pleased with the way the work has been accepted by the county agents and by the public school people.

HORSES AND MULES.

There is no one in the Animal Industry organization whose particular business it is to look after the horse and mule phases of our work, so what little has been done, I have looked after myself. When we consider that this is the biggest phase of the live-stock interest of the State, it seems that we should have an extremely competent man to care for this part of the live-stock work, and I hope such a position may be created within a short time.

THE VALUE AND PLACE OF COTTON-SEED MEAL IN A RATION FOR HORSES AND MULES.

This experimental work is being carried on at the Iredell and Pender Test Farms. The six mules on the Pender Test Farm were divided into two lots on January 1, 1914. One lot is fed corn alone and hay, while the other lot is given a small supplementary feed of cotton-seed meal. The work has not been under way a year yet, so no reports have been made, but they have gone far enough to show that cotton-seed meal is not only cheapening the ration, but is keeping the animals in a healthier condition than when corn alone is fed. Complete daily records are being kept of the amount of grain and hay eaten by each animal, the number of hours each animal works daily, and individual weights.

The same kind of records are being kept at the Iredell Test Farm, where the same kind of work was inaugurated April 1, 1914. At the Iredell Test Farm complete feed records, work records, and weight records are being kept of the brood mares and the young colts.

Numbers of requests come to the office from the farmers of the State, asking us to assist them in buying brood mares, stallions, and jacks. We had very little time to comply with these requests. If a competent man were placed in charge of this phase of the work the farmers could be assisted very materially.

FAIRS AND INSTITUTES.

The authorities of the State and county fairs have availed themselves of our help in numerous instances. In all, members of this Division have judged the live stock and poultry at twenty-two State and county fairs this fall.

Members of the Animal Industry force have also been anxious to assist the institute work in every possible way, and have never lost an opportunity to comply, when we could possibly do so, with Mr. Parker's

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requests. The following number of institutes and other agricultural meetings have been attended by the members of the Animal Industry Division:

	Institutes.	*Other Agricultural Meetings.*
Gray	2	5
Curtis	13	20
McVean	1	5
Eaton	16	4
Reed	10	50
Combs	10	50
Farnham	10	50
Shook	12	4
Ross	6	6
	80	194

POULTRY.

Mr. Taylor, who was in charge of the poultry work at the Central Station, handed in his resignation, to take effect September 1, 1914. To fill this position we have been able to secure the services of B. F. Kaupp of South Carolina. Dr. Kaupp is to begin work November 10. On account of the fact that there was an interval between Mr. Taylor's resignation and Dr. Kaupp's appointment, no effort has been made to do any experimental work at the Central plant since June. The work will be inaugurated, however, soon after Dr. Kaupp's arrival. He will have charge of the poultry work on the test farms, and plans are being made to inaugurate poultry work upon three at least.

POULTRY WORK ON THE IREDELL TEST FARM.

Careful poultry work is already under way on the Iredell Test Farm, the work being inaugurated April 1 of this year. We are beginning with a flock of single-comb Rhode Island red hens. We expect to keep the number of hens somewhere around 100. As the work progresses careful study will be made of the various concentrated feeds and green crops for raising young chicks and producing eggs. Since the inauguration of the work careful records have been kept of the number of eggs produced, of the number of chickens hatched, of the amount of grain eaten, of the number of deaths, and of the sales. Since April 1 the number of hens on hand (about 100) produced 4,512 eggs from April 2 to September 23. Up to September 23 a total profit of $64.10 had been made on the flock. A good and modern henhouse has recently been constructed, and we are now in position to take care of the flock during the winter months.

APPROPRIATIONS.

We should all appreciate the help given us by the authorities of the Bureau of Animal Industry at Washington, D. C. Since January 1, 1913, arrangements have been made with Washington to assist us in both experimental and field work. They are rendering very material assist-

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ance in our beef cattle experimental work, in our beef cattle field work, in our dairy field work, in our pig club work, and in our poultry club work. In fact, the Bureau of Animal Industry at Washington is now spending no less than $18,000 yearly in North Carolina to assist in advancing the live-stock interests of the State.

To carry the work along which the Board has already authorized will require the amounts indicated below. I am not asking in this budget for money to inaugurate new projects; the sums only provide for the work under way. I am asking that Mr. Peden's and Mr. Combs' salaries be slightly increased; these are both good men, have been doing exceptionally good work, and have been working a long time without increases. They should be encouraged.

SALARIES.

Gray	$ 750.00
Curtis	Hatch and Adams
Shook	700.00
Peden, Washington plus	100.00
Brown, Washington plus	150.00
Ikeler, Washington plus	150.00
Eaton	800.00
Reed, Washington plus	150.00
Combs	700.00
Arey, Washington plus	150.00
Farnham	Washington
Ross	Washington
McVean	Washington
Kaupp	Hatch and Adams and College
Miss Duckett	420.00
	$4,070.00

RUNNING EXPENSES.

Dairy field work	$2,500.00
Dairy experiments	450.00
Beef cattle and sheep	850.00
Swine	500.00
Poultry experiments	500.00
Poultry clubs	500.00
Pig clubs	500.00
Incidentals, as clerical help, janitorial help, blue-prints, circular-letters, stamps, etc.	1,500.00
Swine experiments	1,000.00
	$8,300.00

RECOMMENDATIONS.

At least two forward steps should be taken at this time.

First, the Animal Industry Division should be provided with a well trained and strong man to look after the horse and mule interests of the State. This want is especially emphasized when our attention is called to the fact that the State now has $42,127,821 invested in horses and

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mules—an amount more than twice as great as that invested in beef cattle, dairy cattle, hogs, sheep, and goats combined. This great interest deserves more attention than we are giving it.

In the second place, we feel that the State Department of Agriculture could be of material assistance to our farmers if plans could be matured for installing a State-owned creamery at Raleigh. This creamery would be maintained with three main objects in view: First, it would place us in position to develop a larger dairy section throughout the central and eastern parts of the State, by establishing cream routes to be given up just as soon as local creameries could take over the business—no competition, therefore, arising with other interests; second, this creamery would enable us to develop excellent creamery managers and buttermakers in our own State; third, the creamery would afford an excellent opportunity for studying the manufacture of cheese and other dairy products. If proper arrangements could be made, the plant could be installed, ready for business, for no more than $1,000. This plan proposed is nothing new; several States having been doing work similar to this.

Very respectfully submitted, DAN T. GRAY,
Chief, Animal Industry Division.

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BIENNIAL REPORT OF ENTOMOLOGIST, 1913-1914.

HON. W. A. GRAHAM,
Commissioner of Agriculture.

SIR:—I submit herewith report on the operations of the Division of Entomology during the years 1913 and 1914.

This Division is charged with work on the insects of the State, especially the study of methods for the control of destructive insect pests. We are also charged with inspection duties, work on test farms, at farmers' institutes, exhibits at State Fair, etc.

CORRESPONDENCE.

The regular office correspondence maintains a general average of from 1,500 to 2,000 letters per year, exclusive of circular-letters. These letters cover every conceivable question in regard to insects—their identity, their injuries, their control, their habits, etc.—and the answering of these questions not only requires time for dictation, signing, etc., but frequently the questions are of such a nature that considerable time must be spent in study before satisfactory answers can be given. Office records are kept of all complaints of serious injury by insects, so it is possible to tell, year by year, just which kinds of insects have been the cause of most complaint.

MOST DESTRUCTIVE INSECTS FOR THE TWO YEARS.

Cotton Boll-Worm.—This insect was most complained of during the late summer and fall of 1913, coincident with extensive damage by the fungous disease known as "anthracnose"—indeed, bolls were often sent in which showed both troubles, usually the boll-worm being responsible for only minor injury. It is present in our fields every year, but only in exceptional years does it do really serious injury.

Corn Stalk-Borer.—This pest was more destructive during 1914, and reports were received of serious damage in many fields. Late planting, destruction of stubble left in fields, and rotation offer the best methods of protection.

Cotton Leaf-Louse was more numerous in 1914, but serious damage ceased with advent of settled hot summer weather. In many cases the numbers of the lice were reduced by parasitic and predaceous insect enemies.

Army-Worm.—This pest did notable damage in 1914; indeed, this is the only year in the present century when this particular species has caused widespread damage. It destroyed millet, corn, oats, and grasses. It was made the subject of some interesting special studies by this office. Checking the advance of the worms by a deep furrow was generally suc-

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cessful when resorted to in time. The worms were killed in large numbers by several parasitic flies, one species being especially useful in this.

The San Jose Scale is always the subject of frequent complaint, but in 1913 it brought forth a particularly large number of inquiries, no less than fifty-nine complaints being recorded in our correspondence for the year. Fortunately, the lime-sulphur washes and soluble oils have become so well developed and so widely sold and used that there is little real need for trees to be killed by this pest after the owner once knows of its presence.

Black Peach Aphis was abundant in 1913; *Peach Borer* was also abundant in 1913.

Fruit Bark Beetles have been complained of more than usual during the late summer and fall of 1914. This we attribute to the large crop of this year having left the trees in a rather weakened condition, which renders them more attractive and at the same time more susceptible to these insects.

Gloomy Scale continues to be a source of serious injury to maples, especially the red maple and silver maple.

Upon the whole, insect pests seemed to be more abundant and destructive in 1913 than in 1914. Our records show that in 1913 there were 139 species reported, with 421 complaints, while in 1914 (to date) there have been 108 species reported, with a total of 329 complaints.

INSPECTION WORK.

Nursery Inspection.—Every establishment in the State which grows fruit trees for sale is inspected each year by this office, and a license to carry on trade is issued if the trees are approximately free from serious pests. If they are not in this good condition, the license is withheld until the premises are so cleaned up and the pests destroyed to the extent that it seems safe to permit the sale of the trees remaining. Sixty-three such establishments were licensed in 1913, and to date (November 14th) fifty-one have been licensed for 1914. These inspections are made chiefly by Assistant S. C. Clapp.

Orchard Inspection.—As a companion task to the inspection of the nurseries of the State, this office also does a great deal of work in inspecting the fruit orchards. This work has been going on about seven years, during which time we have visited all of the larger fruit sections and have come in personal touch with many of our seriously interested orchardists. The improvement in the conditions of the fruit orchards of the State has been in no small degree due to this work, and by means of it scores of our growers are now spraying their trees with success and profit, when only a few years ago they were disappointed and discouraged with the fruit business. It seems unnecessary to go into details in this connection to show how many orchards have been inspected, but a record of every inspection is kept on file in this office.

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Inspection of Plants from Abroad.—In the winter of 1908-09 it was discovered that many trees and shrubs being brought into this country from Europe were infested with the Brown-Tail Moth, and to a less degree Gypsy Moth. Both of these insects have cost the New England States hundreds of thousands of dollars. Consequently State inspection officials began at once to inspect every such shipment that could be found. Even in this State we actually found Brown-Tail Moth in one of the shipments. We have never since felt warranted in relaxing vigilance in this matter; and now, since the establishment of the Federal Horticultural Board, we are expected to report on all such inspections to the Federal authorities, they, in turn, giving us notice of all shipments that enter the shipping ports which are destined to our State. This has grown to be a very considerable task, and is entirely in addition to the duties which the State normally expects of us—a task which is unknown and appreciated save by those who do the work. During the winter of 1913-14 we inspected 47 such shipments, and up to date for the season 1914-15 there is promise that we will have as many or more. The present disorganization in Europe renders it more than ever necessary that we should make these inspections, as there is greater probability of the inspection work in those countries being done hastily or inefficiently.

FARMERS' INSTITUTES.

The Entomologist, during the past two years, has taken part in the farmers' institutes which are held throughout the State. By this means we are able to bring our work to the attention of many who would not be reached otherwise.

STATE FAIR.

This Division has one booth in the Department display at the State Fair. While showing something in our varied lines of work, we have especially emphasized orchard spraying as a means of protecting our fruit interests, showing yields of sprayed and unsprayed halves of the same apple tree side by side. We feel that the lesson thus taught must have helped many, as we had a supply of publications on hand which adequately explain the process.

TEST FARM WORK.

During last winter arrangements were made by which this Division becomes responsible for the insect control work on the several test farms.

The largest single part of this task is the spraying of the orchards, as there are several thousand trees on these farms which must be thus treated several times each year. We are pleased to note that the spraying done by us this year was attended with good results.

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INVESTIGATION AND EXPERIMENT.

Soap and Water Solution for Plant Lice.—During the past several seasons we have made a number of simple tests with laundry soap dissolved in water as a remedy for many kinds of troublesome aphids. We have found that on small areas this gives an entirely satisfactory method of control, doing away with the need of preparing the more complicated Kerosene Emulsion or ordering the tobacco extracts from a distance. One pound of laundry soap cut in thin pieces and dissolved in 2 gallons of hot water, then dilute by adding 2 gallons of cold water (1 lb. soap to 4 gals. water finally), gives a solution which is fatal to practically all aphids which are wetted by the spray.

The Cotton Red Spider has been studied to some extent by Assistant C. L. Metcalf, and his work, taken in connection with work by the Federal entomologists, has thrown some light on the methods of control.

Potato Spraying Tests have been conducted for two years on the Buncombe Test Farm, with the result that the standard Bordeaux Mixture poisoned with arsenate of lead still holds our favor as the best material for the purpose.

Woolly Apple Aphis has been worked with to some extent on the test farms, tests showing good effects from tobacco extracts, and indicating danger from the use of oil applied directly to the roots of young apple trees.

Pecan Insects.—The study of the whole group of pecan insects was undertaken a year ago by Mr. C. L. Metcalf. Mr. Metcalf's recent resignation brings these studies to a close temporarily, at least; but his notes and observations have given a sound start to the study of this subject.

COLLECTIONS.

One of the branches of work in which we take particular interest is the maintaining of a collection which is designed to illustrate the insect life of the State, including all species, whether harmful, beneficial, or neutral. This collection is already creditable and of sufficient value and interest so that we feel that it should not be neglected. Its many thousands of specimens represent the "odd moments work" of many years, and is a source of comparison and study by those connected with the office, of interest to visitors to the office, and a source of material for display at meetings, fairs, etc. During Mr. Metcalf's term of service he added greatly to our collection of Syrphus-flies, a group of little-appreciated insects which are of importance in controlling plant lice. It is my hope that our collection shall be improved as time goes on until it shall become a more and more adequate source of information concerning the insects which occur in North Carolina.

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PUBLICATIONS.

During the time covered by this report we have issued the following publications:

Oyster Shell Scale in North Carolina. By F. Sherman. Monthly Bulletin of State Department of Agriculture, June, 1913.

Insect Enemies of Corn. By F. Sherman. Bulletin for May, 1914.

Orchard Spraying, etc. By F. Sherman. Circular.

The demand for all of the publications of this office is quite active—indeed, a previous bulletin on Corn Insects had been exhausted, and the circular on Orchard Spraying is the most recent of quite a number of publications on the same subject. Many thousands of copies of bulletins and circulars on orchard spraying have been sent out, and we are bold enough to claim that the orchard practice of at least many of our progressive growers is giving tangible evidence of their teachings.

EFFICIENT WORK OF ASSISTANTS.

Far be it from me to claim that whatever of merit there may be in the work of this Division is due merely to my own efforts. Were it not for the efficiency, loyalty, and unselfish efforts of the two men who have been associated with me during this time, there would be far less of merit to report. Mr. C. L. Metcalf, as Assistant Entomologist, has done most of the experimental work, including the potato spraying and studies of Cotton Red Spider, Woolly Apple Aphis, and pecan insects; besides which he has added materially to our collection, taken photographs, and attended to much of the office routine, especially during my absence. His recent resignation leaves a vacancy which it will be difficult to fill with equal satisfaction.

Mr. S. C. Clapp as Assistant in Field Work has done practically all of the nursery and orchard inspection work; has inspected many of the imported shipments, and has attended to much of the spraying on the test farms.

My own time has been devoted chiefly to the executive duties, correspondence, attendance at institutes, preparation of publications and reports, supervision of field work by the assistants, and, when possible, taking an active part in the field work itself.

Respectfully submitted, FRANKLIN SHERMAN, JR.,
Entomologist.

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REPORT OF DIVISION OF HORTICULTURE.

MAJOR W. A. GRAHAM,
Commissioner of Agriculture.

SIR:—In compliance with your request, I hereby submit the report of the Division of Horticulture for the years 1913 and 1914.

OFFICE WORK AND CORRESPONDENCE.

As the horticultural work of the State progresses, it naturally increases the office work and correspondence. An increasingly large part of my time is taken up, necessarily, with the direction of horticultural work on the test farms and throughout the State. Each year an increasing number of inquiries come from all parts of the State, covering practically the whole range of horticultural work. On returning from field work, it often takes several days to get through with the correspondence necessitated by horticultural inquiries that have come in during my absence. An additional amount of correspondence is entailed in obtaining data of the spring prospects for fruit, and the getting out the reports to growers of the prospective crop in the State and the comparative crop throughout the United States.

FIELD WORK.

The field work in this Division has greatly increased, owing to the fact that there is a rapidly growing interest in commercial orcharding. An increasing number of calls are coming in for us to look over land and advise as to its suitability for commercial orcharding. Business and professional men in towns and cities, especially in the western part of the State, are buying mountain lands and developing them into commercial orchards. Such men are much more inclined to call for our assistance than the farmer is himself. During the last two seasons a considerable number of prospective orchard properties have been visited by myself, or by my assistants, and reports on their suitability, or otherwise, have been made to the owners. There are now on file a number of calls for orchard demonstration meetings, to show the growers how to properly plant their trees, and also how to prune and shape the young trees of one or two seasons growth.

PECAN WORK.

For several years I have been working persistently and systematically to encourage pecan growing in eastern North Carolina with the future hope of its developing into a commercial industry. I have received and answered thousands of letters on this subject. Every letter regarding pecans I have kept separate from my regular correspondence and placed

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in special files. In the years I have been working along this line I have accumulated a whole series of files on the one subject of pecans. A few weeks ago I began to wonder what I had accomplished toward the development of the pecan industry in the State. I set an assistant and a stenographer to work on these pecan files to prepare a mailing list. In tabulating this list they found that there were inquiries not only from our own State, but from all the States and even from foreign countries. When the State list was tabulated and indexed I had the following circular-letter prepared and sent out to the entire list:

This office is endeavoring to obtain a list of all the pecan growers in the State. If you will coöperate with us by answering the following questions we will be pleased to place your name on our mailing list for all future publications on nut growing:

Have you any pecan trees?

How many seedling trees? What ages?

How many budded or grafted trees? What ages?

Kindly give the varieties you are growing, with the number of trees and age of each variety.

Will you be interested in a bulletin on the top-working of seedling pecan trees?

Kindly give below the names of other persons who are growing pecans.

Thanking you for this information, I am,

Very truly yours.

The response to this letter was very gratifying and brought us a flood of replies. These reports were carefully tabulated. The final summing up shows that we have 82 commercial pecan growers in the State. I set 25 trees as the minimum limit for a commercial grower. From this they ran all the way up to 2,000 trees. The total census showed 15,879 seedling trees and 11,151 named varieties.

This large increase in grafted and budded pecan trees is very gratifying, for six years ago there was not a commercial orchard of named varieties of pecans in the State. There is no line of horticultural work in the State that is at present attracting so much attention as pecan growing. More orchards of budded and grafted trees will be set this winter than ever before.

As a further evidence of the interest in pecan growing the two bulletins that I have written on this subject are practically exhausted. Though our last pecan bulletin was the largest edition ever gotten out of any Department bulletin, the call for it has been so constant and so widespread that we have but 200 copies of it left out of the original 50,000. This will necessitate the publication of a second edition of this last bulletin.

Our activity in the development of commercial pecan orchards in North Carolina is attracting considerable attention in the literature of nut growing, and is placing us in a favorable comparison with the commercial nut-producing States. My bulletin published last spring on the

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"Top-Working of Seedling Pecan Trees" has encouraged many of the owners of seedling trees to top-work their seedling groves to named varieties.

The pecan collection in my office has grown to such proportions that it is the largest and most comprehensive collection in the United States outside of the National Department of Agriculture. On account of our activity along this line all the States in the pecan belt are looking to us for information.

THERMAL BELT INVESTIGATIONS.

This summer, in connection with the experts of the National Weather Bureau, I spent four weeks inspecting the thermal stations. In this line of work we are collecting some very interesting and valuable data in regard to elevation and slope of orchards as regards injury from cold. On some of our stations we have gotten all the way from 2 to 20 degrees difference in temperature on a hillside in a single night. For example, at the Thermal Station at Tryon, in Polk County, we had a frost one night at the recording station down by the Pacolet River, while the instrument on the side of Warrior Mountains, 600 feet above, recorded a temperature of 52 degrees. When a difference of 2 degrees will often make the difference between the success or failure in a fruit crop, it can readily be seen what exemption from cold these higher elevations give.

In visiting these thermal stations other very valuable data were brought out in the fact that certain varieties, owing to late habits of blooming, had great immunity from injury by cold. For example, the Mother variety of apple gave heavy crops of fruit in orchards where nearly all other varieties had their crops killed. This was owing to the fact that the Mother variety blooms two weeks later than most varieties. The Ingram apple was also found to have a high degree of immunity, while the following varieties are given in the order of their relative immunity to cold: Virginia Beauty, Gragg, Stark, Missouri Pippin, Wealthy, Hoover, Smith Cider, Buckingham, Bonum, Rome Beauty, York Imperial.

In order to better study the effect of the local topography on the temperature at each station, it was decided to make a survey of each orchard where the instruments are maintained and of the adjoining territory, and from these data to make detail contour maps.

FALL FAIRS.

Believing that the County Fair is one of the primal agencies for educating the farmer and fruit grower in up-to-date agricultural methods, I am giving an increased amount of attention to fall fairs throughout the State. The Horticultural Division has supplied an expert judge to practically every fair in the State that attempts to make a fruit exhibit. I have offered to construct and revise the premium lists of any fair that

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desires to specialize in horticultural work. A number of fairs have taken advantage of my services in this direction. At each of these fairs I have endeavored to set proper horticultural standards and to encourage the production, grading, and packing of high-class commercial varieties. I have, myself, classified and judged the fruit at the Wilkes County Fair since its inception, and its development along these lines of modern horticultural methods has been so pronounced that their fruit could hold its own in any State or National exhibition. In order to make this improvement general throughout all the fairs, I have arranged to send to as many fairs as possible an educational exhibit in Horticulture. This exhibit was thoroughly prepared and ably demonstrated this fall, during the month of October and part of November, by Mr. Hill, Assistant Horticulturist. Though the preparation and installation was somewhat expensive, and especially its transportation, the work was so energetically and tactfully handled by Mr. Hill that the experiment was considered a decided success, and well worth extension and development. This will form part of the special report on fair work that I ask leave to present at this meeting of the Board.

AWARD OF WILDER MEDAL.

In my last report I mentioned the preparation of a horticultural exhibit to represent this State at the exhibition of the American Pomological Society, in Washington, D. C. I have now on display the silver medal awarded to us by the Pomological Society for this exhibit. This medal is the highest award of honor given by the National Society.

BULLETIN WORK.

During the last two years three bulletins have been published by this Division, and one bulletin reprinted. Last year a bulletin was issued on the commercial production of strawberries. This line of investigation was assigned three years ago to Mr. S. B. Shaw. He has, since that time, been collecting data on that subject, and this season he made a careful investigation of the culture and marketing of this crop throughout the commercial strawberry region of this and adjoining States. This bulletin is the result of his study and investigations for these three years.

The first bulletin in 1914 was on the "Top-Working of Seedling Pecan Trees." This bulletin gives in detail the operations of patch budding, the method we have found most successful in our experiments in the last four years in pecan propagation. There has been a wide call for this bulletin from all over the Southern States. The third bulletin is on the "Construction and Management of Air-Cooled Apple Storage Houses," and is the result of our investigations along this line for the last three years. The publication of this bulletin came just at the opportune time to offer help to our growers, who on account of depressed financial conditions were unable to profitably market their crop.

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Although an original edition of 50,000 was published, the demand for the Canning Bulletin has been so heavy that it was necessary to get out a second edition to satisfy the constant calls for it. In like manner, the heavy call for them has exhausted the supply of our bulletins on Apples. Varieties, Pruning and Tree Planting. New and revised editions of these bulletins will be prepared for press this coming winter.

FRUIT CROP REPORTS.

In order to get the fruit industry of the State on a business basis and keep the trade informed of the amount of our crop in North Carolina, I have been, each spring, sending out reporting blanks to all our commercial growers and compiling therefrom and publishing a report of the North Carolina fruit prospects in all the horticultural and trade papers.

TEST FARM WORK.

PENDER FARM.

Lettuce.—Last year, owing to the continued ravages of the lettuce wilt, we decided to discontinue the crop for a year to see if in that time the spores of the disease would die out. This fall we are beginning again, in a small way, with new land, new frames, and new covers.

Strawberries.—Last fall we began experimental work with strawberries. We have a fine planting ready for fruiting this coming spring.

Sweet Potatoes.—This season we raised a crop of several varieties of sweet potatoes both from "draws" and from cuttings of the vines. These have been harvested, placed in storage, and kiln-dried. The dry rot, which gave us so much trouble in storing last season, seemed to be in evidence again; so I got in touch with the expert of the National Department of Agriculture, who has that special work in charge. As this disease seemed to be showing itself in most varieties, we have decided not to try to store this season, but to put the potatoes on the market for immediate use, before the disease develops. The specialists of the National Department of Agriculture assured us of their coöperation in securing seed free from disease for next season.

Cantaloupes.—In order to improve the quality of the cantaloupes throughout the commercial melon shipping regions of the State, I obtained from a Colorado cantaloupe breeder several strains of high quality melons. The seed of these were distributed to a number of growers, and also planted on the test farms. A crop of very handsome, uniform, and high quality cantaloupes was produced. From these we saved a considerable quantity of seed for distribution next spring.

In coöperation with the Division of Markets, we have also visited the commercial cantaloupe sections and demonstrated to the growers the methods of grading and packing necessary to obtain the highest market prices.

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Rotundifolia Grapes.—The work with Rotundifolia grapes has been carried forward this year along the lines laid down in previous reports. This season a portion was laid off in an extensive series of fertilizer and cultural tests. These will be continued for a series of years.

Pecans.—Our pecan trees are now getting large enough for us to look for a commercial crop. Our trees bloomed very heavily this spring, and we had hoped that we would get a crop this season. The very extended drought, however, caused most of the blooms to shed, and we have only about enough nuts left for exhibition purposes. Many trees bore 2 to 5 pounds, and the total crop of the Pender orchard was 30 pounds.

As a result of our pollenation and cross-breeding work two years ago, we now have a fine lot of trees to set out this coming spring. It is hoped that from these we may produce some new native varieties of pecans specially suited to North Carolina conditions.

Other Nuts.—We are extending our collection of nut-producing trees by adding for trial the following commercial nuts: English walnuts, Japanese walnuts, Japanese chestnuts, hazelnuts, and almonds. The English walnuts are eastern varieties budded on stocks of the native black walnut. This should tend to make them especially suitable to southeastern conditions. The hazelnuts were obtained from the south and west and represent all the best commercial varieties. The almonds, which I secured as bud-wood through the National Department of Agriculture, are being propagated on peach stock in the J. Van Lindley Nurseries and will be ready for setting this coming spring.

Summer Apples.—On the Pender Farm we set out last year an experimental orchard of summer apples. The eastern part of the State offers good possibilities for the production of early apples that mature and go to market before the extreme heat of summer. The trees have made a remarkably fine growth during their first and second seasons.

EDGECOMBE TEST FARM.

The pecan orchard on this farm is rapidly growing into a very handsome orchard and is attracting the attention of people passing by the farm. The trees have grown so large that they will soon need the entire land. Although it produced a good crop this year, I have under advisement the removal of the filler peach orchard. It will be left for a few months, pending fruit prospects this coming spring. The land between the rows bore a heavy crop of soy beans which is being pastured off under the direction of the Division of Live Stock. Therefore, while growing pecan trees the land has also been producing revenue crops.

IREDELL TEST FARM.

Our work for the control of pear blight has been very successful. The isolation method followed kept the trees in good healthy condition. This year we had a magnificent crop of fruit, and the color and quality was

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the finest I ever saw. The peach trees also produced a good crop. The apple trees are not in bearing, but are making a very satisfactory growth.

BUNCOMBE TEST FARM.

The old Limbertwig orchard that Mr. Collett renovated two years ago gave a very heavy crop this season. In spite of the heavy load of fruit, the quality is the best we have ever had. This is largely due to the fact that the spraying on the test farms has been taken over by the Division of Entomology, which is able to specialize along this line of work. The young apple trees on this farm have not done as well as on the other farms.

BLANTYRE TEST FARM.

The Blantyre orchard produced this year its first commercial crop. The roads put in last year permitted thorough spraying of the trees. The fruit was of large size and of the very finest color and quality. We made an exhibit of the test farm apples at the Asheville Fair, and also had ten barrels of them sent to the State Fair, for use in our packing demonstrations. Nearly every one who saw this fruit remarked on its specially fine quality. The fruit was sold after the fair and the proceeds turned into the receipts of the farm.

The young orchard back in the cove is making a satisfactory growth. A good crop of Irish potatoes was made this season on the land between the trees.

Respectfully submitted,

W. N. HUTT,
State Horticulturist.

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REPORT OF FOOD AND OIL DIVISION.

MAJOR W. A. GRAHAM,
Commissioner of Agriculture.

DEAR SIR:—I beg to submit to you a report of the Food and Oil Division of the Department, covering the work that has been done during the two years, December 1, 1912, to December 1, 1914, and some other matters for consideration.

UNDER FOOD LAW.

The State Food Law, chapter 368, Public Laws of 1907, makes it the duty of the Department of Agriculture to enforce the law, without making any provision of funds for the purpose. The Department, therefore, has to use its funds from other sources and intended for other purposes for the enforcement of the Food Law. Sufficient funds to properly enforce the law are, therefore, not available, but such funds as are available for the purpose are used to the best advantage.

Two general inspections were made annually, each covering the entire State. As far as possible, every place where foods and beverages are offered for sale in the State was visited. Samples were purchased and paid for by the inspectors just as they are obtained by the consuming public.

During the two years 2,828 samples have been collected from practically all the towns in the State and examined, as follows:

Beans, canned	6
Beers, imitation and near-beers	74
Butter and butter substitutes	94
Chemical fruit preservatives	4
Cheese and skim-milk cheese	102
Cider and imitation ciders	48
Cinnamon extracts	5
Coffee and coffee substitutes	152
Currants, dates, figs, and raisins, dried	30
Fish, salt mullets	10
Flour	101
Honey and honey substitutes	15
Ice-cream and ice-cream substitutes	175
Lard and lard substitutes	58
Lemon extracts and lemon extract substitutes	267
Maple sirup and maple sirup substitutes	45
Meal, corn	88
Milk and cream	116
Milk, condensed	35
Miscellaneous	30
Molasses and sirups and substitutes for same	417
Olive oil	6
Orange extracts	11

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Peas, canned	62
Peppermint extracts	6
Rice	22
Sweet oil and sweet oil substitutes	87
Vanilla extract and vanilla extract substitutes	157
Vinegar and vinegar substitutes	605
	2,828

The results of the examination, together with the conclusions drawn from same as to whether the product was adulterated or misbranded or the law had been violated in sale of same, and the names and addresses of the manufacturers and dealers, have been published in the Annual Food Report, the December Bulletin of the Department, and sent to the dealers of the State.

The conclusions drawn from the results of the analyses and other information published in the report afford the dealers an opportunity of knowing how to comply with the law.

When the results of the examination of a product show evidence of a violation of the law, the offending party is notified and offered an opportunity to show cause, if there is any, why he should not be prosecuted. Such hearings require considerable time and increase the correspondence a good deal, but they are well worth the time, for when a dealer is called upon to show cause, if there is any, why he should not be prosecuted for a certain violation of the law, he usually takes notice. A hearing often puts an offender to some trouble and expense, though not as much as a prosecution in court, and brings him to see that he must comply with the law.

The subject of food adulteration and the enforcement of the law against same is a difficult proposition. In some cases adulterants in food are easy to detect, while in others they are exceedingly difficult, either chemically or otherwise, and require long, difficult chemical analyses for their detection. The chemistry of foods is highly technical and difficult, and after the analyses are made one must have had broad experience and be familiar with the subject to be able to judge from the results with any degree of certainty whether a product is or is not adulterated. Manufacturers who desire to profit by the adulteration of food products employ at great expense the most able chemists and attorneys to be had, and to meet their combined efforts the Food Law official has a hard road to travel.

The inspections have generally been satisfactory, but the more that is known about food adulteration and food inspection and food law enforcement, the more complicated they prove to be, and from time to time new troubles arise.

When the Food Law was passed it was thought sufficient and that all evils existing in the sale and handling of food products could be remedied under it; but not so. The Food Law officials often find themselves

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hampered for lack of authority of law, and in many places it is impossible to enforce the law as it now stands. The law forbids the sale or offering for sale any food or beverage that is adulterated or misbranded. It also requires a dealer to deliver samples for examination when demanded by an inspector and the price of same is tendered; but it does not authorize an inspector to go into a dealer's stock to look for objectionable products. So he can only demand what he sees. The sanitary condition of such places is not covered by the Food Law, and as Food Law officials have but little authority, except in the sale of meats, to make dealers keep their places clean, it cannot always be done, though their attention is often called to the filthy condition of same.

As food is quite subject to very objectionable contamination when handled in filthy, unclean, insanitary places, contamination by bacteria or germs that produce disease, and is far more dangerous to health than much of the intentional adulteration found in food, it would appear, for the protection of health, that the Food Law might well be amended to cover the sanitary condition of places where food is manufactured, kept, and dispensed.

Many bakeries, bottling plants for soda water, ice-cream factories, and other places where food is handled are kept in unclean, insanitary condition, and are hotbeds of diseases. Doubtless many people have contracted disease, such as fever, etc., from such places, and then wondered what caused their illness, without being able to locate the trouble.

There is much fraud committed in the sale of food in packages that have come to be known as certain weight packages, as 1, 2, 3, 5, or 10 pounds, etc., though the weight is not stated on the label, that fall far short of their supposed weight.

The National Food Law has been amended so as to require, as far as possible, the net weight or measure of foods in package form to be stated on the label of the package. As State commerce is not subject to the National law, it would appear that a similar amendment to the State law would prevent fraud and be of much benefit to the consuming public.

As stated in the last biennial report, the work for the enforcement of the Food Law has always suffered for the lack of sufficient funds to carry it on properly and to obtain the best results, but we have cause to feel gratified at the results so far obtained with the funds available.

UNDER OIL LAW.

The State Oil Inspection Law, chapter 554, Public Laws of 1909, as amended by chapter 143, Public Laws of 1911, makes it the duty of the Department of Agriculture to enforce same. The law applies to all kerosene or illuminating oils sold or offered for sale in the State, and places an inspection tax on same to defray the expenses of enforcing the law. Five oil inspectors are provided for by the law. When a shipment of oil is made into the State, the shipper notifies the Commissioner of

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Agriculture, and an inspector meets the shipment, takes a sample, and sees that the inspection tax is paid. One of the five inspectors is constantly on duty at Wilmington, where oil is received in large quantities by barge and shipped to other points in the State. From time to time, as is thought necessary, inspection trips are made to the country stores along the borders of Virginia, Tennessee, Georgia, and South Carolina. Of late the conditions have been found good, and no bad oil is detected.

During the two years 4,193 samples have been collected and examined. The law is being well enforced and very little oil is found that does not meet the requirements of the law and the Department regulations. There are very few or no complaints of bad oil brought to the attention of the Department, which is another indication that the law is being complied with by the oil companies and dealers.

FINANCIAL STATEMENT BY GEORGE LITTLE, OIL CLERK.

Balance in State Treasury December 1, 1912		$ 1,957.57
Receipts December, 1912, to November, 1914, inclusive, deposited in State Treasury		128,571.10
Warrants drawn during same period for expenses	$ 38,179.71	
Warrants drawn in favor of the State Treasurer during same period for transfer to General Fund	91,000.00	
Balance in State Treasury subject to warrant with close of November	1,348.96	
Total	$130,528.67	$130,528.67

Itemized statement elsewhere in Commissioner's report.

Respectfully submitted,

W. M. ALLEN,
State Food and Oil Chemist.

RALEIGH, November 30, 1914.

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INSTITUTE WORK.

MAJOR W. A. GRAHAM,
Commissioner of Agriculture.

DEAR SIR:—Below find report for institute work for the year December 1, 1913, to November 30, 1914.

During this year we have held 250 regular institutes for men, 9 special or orchard demonstration institutes, and 2 institutes for negroes, with a total attendance of 35,632.

There were held at the same time and places 240 regular women's institutes, with an attendance of 33,227. At the meetings of the women's branch of the farmers' institutes the attendance has been 2,324, and at other meetings for women 636, making the total attendance of women for the year 36,187, which is a gain of 57 per cent in attendance, or a gain of 13,180 over last year's attendance.

Our total attendance of men and women for the year is 71,819 against 57,805 for last year. This report does not include the attendance of meetings held by the Demonstration, Boys' Corn Club, and Dairy Divisions, though such meetings are counted in institute attendance in most States. I am hoping to include the attendance at these meetings in subsequent reports.

We again offered prizes for the best loaf of bread exhibited by a woman living on the farm over 20 years of age and to girls living on the farm under 20 years of age, and also to the girls under 16 years of age for the best corn bread. The bread exhibits elicited a great deal of interest. At some of the meetings there were as many as fifteen exhibits of bread.

During the year we have endeavored to organize a local women's branch of the farmers' institute at each place we held an institute. We succeeded in organizing 205 of these women's institutes and have reports from 125 of them. They elect a president and secretary and meet once a month or as often as they conveniently can, and discuss such problems as they are most interested in. Many of these women's institutes have grown from a membership of half a dozen to 25, while there is one that organized with a membership of 12 and has now 50 on its roll. At these meetings they discuss bread making, sewing or dressmaking and the kinds of material to use, beautifying the home, kitchen conveniences, saving steps, school lunches, improvement of the schools, Christmas gifts for children, etc. Frequently they serve hot rolls, salads, etc., which augment the social features of the meeting.

It can readily be seen that an active women's organization working along the above lines will be a force for rural uplift and betterment in any community. The influence for good of a live women's organization

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in any community is incalculable. I think we have struck the right chord in the women's branch of the farmers' institutes in developing community interest and betterment.

It is my purpose to try to organize the farmers along the same line, so that, instead of holding only one institute a year, as we have been doing, to endeavor to get the neighbors to come together and hold an institute among themselves, inviting outside speakers for special occasions. By those means I am hoping to very materially increase the interest in and the usefulness of farmers' institutes. If I can accomplish this, I think the agricultural and all rural interests of our State will quickly take on a very decided forward movement.

It is gratifying to me, and may be of interest to you and to our Board of Agriculture, to know that in attendance at women's institutes North Carolina is the leading State in the Union by about 15,000.

DEMONSTRATION WORK.

The demonstration work that has been done by me during the past year has been confined to alfalfa. Through coöperation with the National Government at Washington I have been able to distribute 300 pounds of alfalfa seed in different parts of the State. This was done in the fall, so that I have yet had no reports from any of them except those who have simply reported that they had a good stand. I am hoping that the distribution of this number of seed will prove to us whether or not we can advantageously and profitably introduce alfalfa culture generally throughout the State.

I am hoping to continue this work the following year and also to add some features to it. As in my report more than a year ago, this work is not in conflict at all with that of Mr. Hudson, but is coöperative rather than antagonistic to his work. As you will see, I have asked for a small appropriation to continue this work.

My assistant, Mr. Sloan, will resign his position as assistant, which may not take effect until the first of April. I am not asking for an assistant to take his place at this time.

Attached to this you will find the appropriations for which I am asking.

Yours very truly,

T. B. PARKER,
Director of Farmers' Institutes.

RALEIGH, November 18, 1914.

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REPORT OF DIVISION OF BOTANY AND AGRONOMY.

To the Commissioner of Agriculture.

SIR:—I have the honor to transmit herewith the biennial report of the Division of Botany and Agronomy, covering the period from December 1, 1912, to December 1, 1914.

Respectfully submitted, J. L. BURGESS,
Agronomist and Botanist.

FOR THE YEAR ENDING DECEMBER, 1913.

FOREWORD.

The Pure Seed Act passed by the Legislature went into effect in July, 1909. From this time until June, 1913, there existed in the Department of Agriculture a distinct division known as the Division of Botany, whose primary function was to examine and test agricultural and vegetable seeds and thus aid the Commissioner and Board of Agriculture in carrying out the requirements of the Pure Seed Law.

Since most of the work of the Division of Botany was, strictly speaking, general agronomy work, the State Board of Agriculture, at its meeting in June, 1913, decided to combine the seed work with, and make it a part of, the work of the Agronomy Division, and thus eliminate otherwise unavoidable duplications.

LINES OF WORK OF THE DIVISION OF AGRONOMY AND BOTANY.

The following are the leading lines of work of this Division:

(*a*) A study of the fundamentals of soil management.

(*b*) Plant breeding or crop improvement.

(*c*) Crop adaptation or the proper adjustment of crops to soil types and climatic conditions.

(*d*) Investigations of methods and dates of seeding.

(*e*) Consultation work.

(*f*) The examination and testing of agricultural and vegetable seeds, required by the Pure Seed Act.

(*g*) Cleaning and grading of tobacco seed.

(*h*) Institute work.

(*i*) Publications.

(*j*) Exhibits.

SOIL MANAGEMENT.

The lines of agronomy work that appeal to the North Carolina farmer most strongly are those dealing with the fundamentals of soil improvement and soil management. The burning question is not what is the right amount, the proper kinds, or the exact combinations of fertilizers to be used for any specified soil or crop, but what must *first* be done

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before our vast areas of worn-out lands will respond, properly, to any kind of fertilizer or cultural treatment, is the question that underlies every other question of successful agriculture in North Carolina. It is along this line of the fundamentals of soil improvement and soil management that much of our time and study are expended.

CROP IMPROVEMENT.

It has been found that any ordinary field of wheat, for example, is composed of a large number of strains or varieties, giving low, medium, and high yields of grain. Some of these strains may yield at the rate of 50 bushels per acre, while others may yield as low as 3 bushels or even less per acre. This variation in yield is true, not only of wheat, but of oats, corn, and other crops.

The work of the plant breeder under such conditions, therefore, is to ferret out, by selection, the high yielding strains and propagate them while discarding the low yielding varieties. This we have been doing for some years with very gratifying results at our different experiment stations.

This year we have at the different stations several thousand head-to-row wheat, oat, rye, and barley breeding plats; a large number of increase plats; increasing into commercial quantities the best selections made last year and the year before. We have, also, plats in the ear-to-row corn breeding work, together with several increase corn plats, propagating the best corn selections made some years previous.

In addition to the above, we have now, and have had during the past season, a large number of variety tests of wheat, oats, rye, barley, and corn at the different stations throughout the State. This line of work carries considerable interest to the farmers, in that it shows the relative values of the many different varieties of those crops that are yearly advertised for sale in the open market. The work really amounts to, in effect, police work, though not done in compliance with statute law.

CROP ADAPTATION.

It has been found that distinct soil types have, in many cases, distinct and different crop values and fertilizer requirements. In view of this fact, we are conducting on the different farms a line of experiments to ascertain what crops or varieties of crops are best suited to our leading types of soil in the different parts of the State.

DATES AND METHODS OF SEEDING.

We have at a number of the stations a line of experiments planned to find out the optimum date to seed wheat, oats, etc., in different sections of the State, and to ascertain, also, the best time for breaking land for these crops. Our results along this line last year were very interesting and gratifying, showing that the greater yields were secured from the earlier seedings.

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CONSULTATION WORK.

Every year witnesses the purchase of farm lands in North Carolina by well-to-do city men who want to project some large farming enterprises. These men do not, in some cases, even profess to know the first principles of agricultural practice.

They accordingly apply at once to the Department of Agriculture for the most detailed instructions regarding the management of their farms. In many cases so much information is desired that a trip to their farms must be made in person and their conditions examined in detail. This done, we write out a clear and concise but more or less general plan for managing the farm and leave it with them for reference.

A copy of a "General Plan for the Management of the Soils and Crops of the Occoneechee Farm," which we wrote in August, 1913, was forwarded to each member of the Board to illustrate this phase of our work. In addition to this, we have visited and made similar plans for the agricultural management of the Silver Hill mining property in Davidson County, the Orphan's Farm at Crescent in Rowan County, a large tract of land for J. R. Blair and Hon. Barna Allen in Montgomery County, and a large farm for Dr. J. R. Ferrell in Pender County.

EXAMINATION OF AGRICULTURAL AND VEGETABLE SEEDS.

One of the chief functions of this Division is the examination and testing of agricultural and vegetable seeds as required by the North Carolina Seed Act. The farmers and seed dealers of the State are making liberal use of the Seed Laboratory in sending us a large number of seed samples in addition to those received from the regular collectors sent out by the Department for that purpose.

The September (1913) Bulletin records the results of the work of last year. This publication shows that from August 31, 1912, to July 15, 1913, we recleaned and tested 732 samples of seed in addition to recleaning and grading a large number of tobacco seed sent in by the farmers of the State.

During the winter of 1910 we demonstrated the recleaning and grading of tobacco seed at Greensboro, in the presence of about 200 farmers. At that time we recleaned and graded enough seed to plant about 200 acres of land. From this small beginning the interest in recleaned and graded tobacco seed has grown until this year we are likely to be called on to reclean and grade enough seed to plant over 5,000 acres of land. Most of the seed comes in small packages from individual farmers for their own use, but occasionally a number of farmers combine and send their seed all in one package. One farmer notifies the Laboratory that he will send us one bushel of seed this year to be recleaned and graded for use in his and a neighboring locality. This one shipment will plant, if properly handled, over 4,000 acres of tobacco. The tobacco farmers are very outspoken in their appreciation of this line of our work.

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It is interesting to note in this connection how effectively the Pure Seed Law is working in this State. During the year 1910-11 an average of one seed sample in every sixteen was found to be adulterated. During the year 1911-12 only one sample in twenty-four was found to be adulterated. During the year 1912-13 the adulteration of agricultural seeds in this State was reduced to the remarkable figure of one sample in every 79.6. We expect next year to reveal not more than one sample in every hundred carrying adulterations.

MANUFACTURE AND DISTRIBUTION OF INOCULATING MATERIAL FOR LEGUMINOUS PLANTS.

For some time we have been studying the value to the farmers of North Carolina of the use of inoculating material for leguminous plants. The use of this material was started in Germany, among the German farmers, some years ago, with varying degrees of success. It finally reached America, and the United States Department of Agriculture took the matter under consideration and began its manufacture and distribution among the farmers in an experimental way.

The technique of its manufacture has undergone several changes and its manner of application to the soil has been changed and improved until now its use is a fixed factor in our agricultural practice. It is no longer in the experimental stage; its value has been proven over and over again, and the commercial companies have gotten hold of the methods of its manufacture and are advertising it broadcast over the country.

Wherever successful inoculation is obtained the crop is increased enormously and the farmer is convinced beyond doubt of its superior value as an aid to crop production. Each successful application of the material serves as a new center of interest and demand for its use.

This season we arranged with the United States Department of Agriculture to have a few hundred acre bottles of this material put up for distribution from this Department. We asked for but a limited number, because we did not think many of our farmers knew anything about it. We then inserted a notice in the different county papers to the effect that we would distribute, free of charge, a limited number of samples of inoculating material for the different legumes to those farmers who had not already used it or grown clover on their farms before. One can imagine our surprise when we received over 1,100 applications from this one insertion of the notice. The vast majority of the farmers already know of its use, and it will be but a short time till the most of them will be using it. We had arranged with Mr. Kellerman for but a limited number of bottles, but finally prevailed upon him to increase our lot to 617, thus leaving nearly 500 applicants without their coveted inoculating material.

This evident widespread demand for the inoculation of legumes among our farmers has convinced us of the wisdom of setting up a small labora-

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tory in the Division of Agronomy and Botany and manufacturing and distributing this material among the farmers of the State at cost.

The commercial companies are selling this material to the farmers of North Carolina at $2 an acre. At this rate, should all of our applicants have bought from, say, the Coe-Mortimer Company of Charleston or the Mulford Company of Philadelphia, they would have sent out of the State $2,200 this fall, and I have no idea that one-tenth of our farmers saw the notice in the papers.

Dr. Kellerman tells me that the material can be made, after the laboratory is equipped, for less than 50 cents an acre. It is plain, therefore, that our farmers are paying more than is necessary for this material, and here is an opportunity for the State Board of Agriculture to do the farmers of the State a great service. I do not contend that the commercial companies are charging the farmers more than the material is worth. A farmer told me the other day that his alfalfa inoculation had been worth at least $100 to him this year. But I do want to call attention to the fact that here is an opportunity for the Board of Agriculture to do the farmers of the State a great service at a very small cost.

I, therefore, respectfully recommend that provision be made for the equipment of a small laboratory for the manufacture and distribution of pure cultures of the nodule-forming bacteria for our different leguminous crops. We will need about $750 for the equipment of the laboratory and from $1,500 to $1,800 with which to secure a man trained in this line of bacteriology. When we compare the cost of manufacture with its value to the farmers of the entire State we find the cost to be extremely low.

FOR THE YEAR ENDING DECEMBER, 1914.

FOREWORD.

It will be recalled that the breeding and other experimental work with the cereal crops on the test farms was transferred from this Division to the Experiment Station in September and is now under the agronomist of the Station. All other agronomic work has been retained.

There are now three leading lines of work of this Division, namely, the work of the seed laboratory, the distribution of pure inoculating cultures for leguminous crops, and the general agronomic work.

THE SEED LABORATORY.

The work of the seed laboratory has greatly increased during the past year, as an examination of the "Report of Seed Tests for 1914" will show. The number of seed samples received for examination during 1913 was 525, while the number received for examination during 1914 was 1,025, exclusive of the very large quantity of tobacco seed sent to us to be recleaned and returned.

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It was during the winter of 1910 that we began, in a very small way, to reclean tobacco seed for the farmers. That year we recleaned about seventy-five samples, enough, perhaps, to plant 300 acres. From this small beginning the work has grown until this year we recleaned and returned enough tobacco seed to plant over 43,000 acres. The farmers are, therefore, appreciating the value of pure, clean seed for the tobacco crop as well as for other crops.

An occasional seed fakir gets in some of his dirty work among the farmers before he can be apprehended, and much inferior and exorbitantly high priced seed has been placed in the hands of some of our best farmers before they were aware of the fraud being perpetrated upon them. A number of complaints have come to this office stating that certain seed peddlers had defrauded good farmers in various parts of the State during the year. Under the direction of the Commissioner, this Division has done all it could in the way of giving publicity to these fellows and warning the people against purchasing seeds from irresponsible seed agents, as seeds should always be bought under a guarantee and samples sent to this laboratory for examination before planting.

LEGUME CULTURES.

At the meeting of the Board of Agriculture in December, 1913, the Commissioner of Agriculture recommended the manufacture of legume inoculating cultures by the Department of Agriculture, in accordance with the Brown Legume Inoculation Bill, passed at the special session of the Legislature in 1913. The Board took the Commissioner's recommendation under advisement and appointed a committee to look further into the matter and report to the Board at its next meeting in June, 1914.

After careful investigation, the committee was convinced of the wisdom of the Commissioner's recommendation, and made a unanimous report in favor of it. Since this was clearly both botanical and agronomic work, the Commissioner and the Board decided to place it in the Division of Botany and Agronomy, and appropriated $1,500 with which to equip a small laboratory and hire an assistant bacteriologist to make the cultures.

By diligent application we succeeded in getting our laboratory equipped and ready for operation by August 18th. We were fortunate in getting our materials together before the European war came on, because we would surely have been greatly hindered had we been forced to delay the work but a few days longer.

After getting the laboratory fully equipped, we searched the whole United States for an assistant bacteriologist on whose ability we could depend absolutely, and were most fortunate in finding for this work Miss Louise Rademacher of Saginaw, Mich., who had already spent five years in making just the kind of bacterial cultures we wanted to put out. She had obtained her training under Dr. Marshall, the noted bac-

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teriologist of the Michigan Agricultural College, and had had, for a number of years, direct charge of the manufacture and distribution of legume cultures among the farmers of Michigan. Miss Rademacher comes to us with the strongest recommendations, not only from Michigan, but from Illinois and Ohio as well, and I am sure the Board will be surprised that her services were secured for the small sum of $1,000 per annum.

Before putting out any cultures, and to make assurance doubly sure, Dr. K. F. Kellerman, who has charge of the Bacteriological Laboratories of the United States Department of Agriculture at Washington, D. C., was invited to come and make a careful examination of our laboratory, proposed methods, plans, etc. This Dr. Kellerman was good enough to do on August 13th. After spending several hours in going over the laboratory and inspecting, in great detail, every department of the work, he returned to Washington and sent us, on August 17th, an official statement, saying: "In my opinion, your laboratory equipment and arrangements for preparing and distributing cultures for inoculating legumes are entirely satisfactory."

On August 18th we began shipping out cultures to the mountain districts of the State. This date was too late, however, to serve the farmers in the higher mountain counties, who sow their crimson clover in July and early August.

During the past season we have distributed cultures for crimson clover, bur clover, alsike clover, alfalfa, hairy vetch, red clover, and sweet clover, these being the legumes generally sowed in the fall. To these we will add, during the coming year, cultures for peanuts, soy beans, velvet beans, garden beans, etc.

It was evident from the beginning that considerable publicity work would have to be done in order to acquaint the farmers of the State with this recent action of the Board. We, therefore, sent a number of articles to each of the daily and weekly papers explaining the new movement and outlining its benefits. We also sent letters to each of the 2,000 farmers' union locals, and, in addition to this, we got out a large poster and sent one to each depot agent, each postmaster, and each register of deeds, to be tacked up in a conspicuous place in every depot, postoffice, and courthouse in the State. We have reason to believe that most of our publicity work hit the mark and that the great majority of the reading public know of this additional effort of the Legislature and the Board of Agriculture to place the agricultural interests of the State on a sound economic basis.

Had we been able to distribute as much as 1,500 acres during the past fall, we could have congratulated ourselves on the results of the first season's work. One can imagine our surprise, therefore, when the orders for these legume cultures from August 18th to November 18th ran up to 7,871 acres.

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We should not fail to note what influence this joint action of the Legislature and the State Board of Agriculture, in manufacturing and distributing legume inoculating cultures to the farmers at cost, has exerted on the wealth of the State.

The commercial companies, as is well known, charge $2 an acre for material exactly similar to that which the Department is putting out. It is clear, therefore, that the Brown Legume Inoculation Bill has effected a direct saving to the farmers of $11,706 in actual cash during the last three months.

From information based on our own experience and the experience of many others in different parts of the country, we feel safe in stating that the use of the legume inoculation distributed from this Department during the past season will add at least one additional $10 to the hay and fertility value of every acre so inoculated. Adding these sums together, we find that this joint action of the Legislature and the Board of Agriculture has added, in one season alone, $90,416.45 to the agricultural wealth of the State.

It may be properly urged that much of this inoculating material would have been purchased from the commercial companies and used, even though the Legislature and Board of Agriculture had taken no action. There is no doubt that this is true, but it is equally true that by cutting the price of the material from $2 an acre to the actual cost of production, hundreds of farmers have availed themselves of the opportunity of getting a genuine article at a reasonable figure who would not have thought of using the commercial product at the prevailing price. We are conceding too much if we admit that half the above amount would have been added to the agricultural wealth of the State, regardless of the joint action of the Legislature and Board of Agriculture; but even taking this view of the matter, what legislator or member of the Board of Agriculture would not be proud to know that over $45,000 had been added to the agricultural wealth of his State as a direct result of his efforts to render the best service to his constituents?

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REPORT ON FARM DEMONSTRATION WORK.

To the Honorable Members of the State Board of Agriculture.

GENTLEMEN:—Complying with your requirement for a report on Demonstration Work, I hereby submit the following, covering both the six months and the twelve months period.

I. TERRITORY.

Since the June meeting of the Board 10 new counties have been added to Demonstration Work. Five more will be added by the middle of January, making 69 counties now in the work. Twelve more have had the work one or more years. This makes a total of 81 counties. If the present favorable prospects materialize, we expect to be able to cover the whole State within the next two or three years. This should be done.

II. FARMERS ENLISTED.

We have enrolled as demonstrators, and directly under the supervision of county agents, 5,859 farmers. Their demonstrations consist of the following: 11,086 acres of corn; 3,068 acres of cotton, and 55,497 acres of other crops, named below. This makes a total of 69,651 acres being supervised directly, or an average of over 1,000 acres per county in demonstration crops.

During the year county agents have made personal visits to 38,607 farmers individually. They have talked to 104,884 farmers in meetings attended. They have probably advised and helped as many others of which we have no record. This would make a total of 286,982 farmers. The demonstration plats have influenced fully as many more, making altogether 573,974 reached.

Aside from this, we have on our lists the names of about 10,000 other farmers whom we usually visit occasionally and to whom we send the bulletins and other publications of the State and Federal Departments of Agriculture, of our A. and M. College Experiment Station, etc. We visit and advise with a great number of farmers of which we have no record. While we do not put much confidence in instruction by correspondence, yet we write several thousand letters for this purpose every year. Counting all these methods of rendering service to farmers, we feel sure that over 300,000 are thus reached annually.

III. COVER CROPS.

Again this season we have put forth a strenuous effort in the matter of planting of winter crops. These are for the purpose of preventing washing and leaching; to furnish grazing and forage, and to add or-

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ganic matter to our almost totally humus-deficient soils. The acreage which we have listed and have had planted of the several crops are as follows:

Clover, 32,510 acres; grasses, 4,240 acres; other cover crops, consisting of rye, vetch, rape, small grains, etc., 12,987 acres. This is a total of 50,737 acres, worth on a conservative estimate $10 per acre, giving as the value of this feature of the work $507,370.

IV. ROTATION OF CROPS.

This season we have started 1,081 farmers with definite systems of rotations of crops. These will furnish valuable object lessons in their respective communities, and will furnish much valuable information to demonstration agents to be distributed over their counties.

V. LIVE STOCK.

Demonstration agents report as introduced into the various counties through their efforts the following live stock: 9 stallions, 145 mares, 116 bulls, 177 cows, 353 hogs, 380 sheep, 2,703 poultry, or a total of 1,180 animals outside of poultry. Practically all of these are of improved blood and for breeding purposes.

VI. ANIMAL DISEASES.

During the year demonstration agents have vaccinated 3,178 hogs for cholera. About 90 per cent of the serum injected seemed to produce immunity when used in time. We are now coöperating with an expert from the United States Department of Agriculture and with our State Veterinarian in an effort to control, and eventually eradicate, this swine plague.

VII. DAIRY WORK.

Demonstration agents have induced the building of 28 silos, mostly in the western half of the State. They have started several creameries with routes in connection. Much of this work was done in coöperation with our State Dairyman.

INCIDENTAL WORK.

It would take a long manuscript to tell of all the work being done by demonstration agents. We will mention, however, that during the year they have laid out the systems and put in 68,100 feet of tiling; they have terraced a number of farms; they have had removed over 20,000 stumps; have had a number of farms "cleaned up"; have sprayed, pruned, wormed, etc., 396 orchards; stopped one outbreak of black leg; ordered 29 cars, 274 tons, of lime for farmers; assisted in building 28 silos; started several hundred pastures; procured one soil survey; organized many farmers into unions or clubs; one agent dehorned 16 cows and castrated 3 mules, 25 hogs, 15 bulls, 8 rams, 21 goats, etc.

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CLUB WORK.

Boys' corn clubs now exist in 97 counties. Only Dare, Watauga, and Washington have none. The total enrollment this season was over 4,500, or 100 per cent greater than last year.

The girls' canning clubs have increased from 11 to 32 counties and from an enrollment of 120 to 1,500. At first they canned only tomatoes. Now they save almost every edible fruit and vegetable grown on the farm.

In coöperation with our Animal Husbandry Division, poultry clubs for boys and girls were started last January. This work has succeeded well. Five counties have been organized with a membership of over 300. Many new poultry houses have been built. Much good stock has been purchased by the members of the clubs. This work is to be greatly extended during the ensuing year.

In coöperation with the same Division, arrangements are now being made to start pig clubs and beef clubs, each in about ten counties to begin with. The Animal Husbandry Division is to help organize the work and to furnish expert information and assistance to county agents. The latter will largely be held responsible for the success of the work in their respective counties. Much stimulus to live-stock growing is expected to result from these efforts. This work, too, will be extended as experience, funds, and demands justify.

INSTRUCTION OF AGENTS.

During the summer we had a course of instruction given by the faculty of the A. and M. College and the experts of the State Department of Agriculture to demonstration agents. The week was spent in taking lectures, inspecting and studying live stock, farm crops, orchards, machinery, etc. A visit was made to our serum plant, where the men had explained to them the making of serum and methods of controlling cholera. Each agent went through the operation of injecting serum into a live hog, so that he is now able to do such work when necessary.

During the winter our Dairy Division held a three-day school of silo-building for a dozen of the agents in the western counties. These men now build very satisfactory silos.

In January we shall hold a meeting in each of our districts (Eastern, Central, and Western) for the purpose of discussing things of special importance in the respective districts.

In addition to the above, county agents are visited regularly by district agents and are further instructed by correspondence from this office and the management at Washington, D. C.

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FINANCES.

Of the $24,000 appropriated by the Board in June for Demonstration Work for one year, half of it, or $12,000, has been used during the six months ending November 30.

Our budget for the ensuing six months calls for a little more than the $12,000 appropriated, but we shall reduce the work, if necessary, in order to come within that amount.

CONCLUSION.

We are not able at this time to make any report on yields of crops grown under our supervision, for the reason that many crops are not gathered yet. An estimate of the matter would be little more than a guess. We expect to get in crop records by the last of December and to have them tabulated some time in January. We will then send each member of the Board these further results.

We are very much pleased to state to the members of the Board that plans are now being laid for greatly enlarging the scope and the usefulness of the work. A Department of Home Economics is to be added. This is for the benefit of farm women. These have been largely neglected in the past. Women workers, of course, will be employed for this part of the work, which is to deal with canning, preserving, pickling, curing, housekeeping, home-making, sanitary measures, food values, cooking, clothing, health problems, marketing, labor-saving devices, women's clubs, etc. There is as much to be done in the house as on the farm around it, and it is of equal or perhaps greater importance. This feature of the work, as has been done with others, will be developed gradually.

We shall need many competent women for this work. We are constantly needing efficient men. We need the hearty coöperation of all leading citizens in making the work a success.

Respectfully submitted, C. R. HUDSON,
Chief, Demonstration Work.

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REPORT OF GIRLS' CANNING CLUBS OF NORTH CAROLINA.

MAJOR W. A. GRAHAM,
Commissioner of Agriculture.

DEAR SIR:—I herewith submit my report of the work accomplished by the Girls' Canning Clubs during the year December, 1913, to December, 1914.

There were organized in North Carolina for Canning Club work from December, 1913, to December, 1914, 32 counties, with an enrollment of 1,500 girls, an increase of 18 counties and 1,100 girls over the previous year.

These girls are divided into 144 clubs with 78 supervisors. Each county has its chief agent, and where there are many clubs in a county this agent has sub-agents to assist in supervising girls and getting standards during the canning season. In two widely organized counties we have as many as eight agents each; in others, five or less.

Thirty of the counties have sent in to me their reports for the year, which state that 259,091 No. 3 tin cans and glass jars of tomatoes, string beans, peaches, berries, and all other edible products of the farm have been produced.

Total value	$35,361.50
Cost	9,425.76
Profit	$25,935.74
Average cost per girl	$ 11.44
Average profit per girl	31.82

One club of fifteen girls, supervised by Mrs. Ross of Alamance County, put up 10,682 No. 3 tin cans, 1,640 glass jars, and 100 gallons of vinegar, and sold fresh $55 worth of vegetables. These things represent $1,563 in cash values, cost $360, profits $1,196, or $86.40 profit per girl. One hundred per cent of the girls enrolled in this club reported the work done.

Mrs. Lamb of Sampson County, a county just started in the work last spring, reports a club of nine girls filling 5,975 No. 3 tin cans, and 102 glass jars with vegetables, fruits, and juices, selling fresh $2 worth of vegetables.

Total money value	$625.00
Cost	162.00
Profit	$463.00
Profit per girl	51.45

Eighty-two per cent of the girls enrolled reported. We have many other clubs making almost as good records.

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Alamance County, which has been in the work three years, reports the greatest number of cans and jars filled.

Number filled	55,165
Sold fresh	$ 226.25
Money value	7,039.65
Cost	1,771.25
Profit	$5,268.40

Seventy-five per cent of the girls enrolled in this county reported. Miss Edna Reinhardt, who has seven sub-agents as assistants, is the chief agent in this county.

Anson County, with Mrs. Redfearn as chief agent, assisted by three supervisors, has produced—

In tin and glass jars	38,540
Sold fresh	$ 162.16
Money value	5,016.20
Cost	1,531.80
Profit	$3,884.40

This county had an enrollment of 63 members, and of these 60, or 96 per cent, reported. They have done remarkable work in glass, sending several hundred dollars worth of shipments north. Austin Nichols, one of the largest wholesale fancy grocers in the United States, has ordered a car-load of preserves from picked girls under Mrs. Redfearn's supervision after seeing a display of their beautiful packs.

Mrs. Capehart of Granville, and Mrs. Bayne of Cumberland County, have also had their selected girls do beautiful glass packs for the northern markets.

We have bent every effort this year toward teaching commercial packing, and out of the 25 counties exhibiting at the State Fair only one failed to show its training in that particular. We were very proud of the uniformly good packs that these counties sent in, and felt much complimented that the Washington office should have selected one dozen glass jars to be photographed for a bulletin as examples of fine standard commercial packs. At the State Fair there were displayed 1,104 glass jars of fruits and vegetables, and two large pyramids of tins.

While in New York I examined the packs of goods sold by Park & Tilford, and found our girls' packs to compare most favorably.

Our markets are good, and most of the counties are selling at home.

Each county supervisor has been growing gradually into a consultant housekeeper for the county; promoting home economics in the country schools by her small cooking clubs, giving instruction in butter-making, marketing farm produce, grading and packing eggs, impressing the gospel of sanitation, and promoting "get together clubs."

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If we had the funds to employ these agents for the whole year, in my opinion there could be found no more efficient means of organizing the country women for better living.

It is almost impossible to say how many miles have been covered by our different county agents in their trips to and fro, but those of us who have gone from county to county, and, in my case, sometimes from State to State, have covered in the aggregate, 21,528 miles.

Miss Scott, my assistant, has traveled 9,176 miles while visiting counties to instruct the agents and give demonstrations of canning in every organized county. Eight months of time have been spent by her in almost constant travel, and she has achieved most satisfactory results.

Miss Evans, second field agent, employed two months in summer to assist in instructing agents, traveled 2,700 miles.

I have to record 9,652 miles traveled partly in North Carolina and partly in other States, being sent out either to instruct, be instructed, or to make talks at New York, Washington, Pittsburg, Cleveland, Louisville, Frankfort, and Lexington. Columbia University financed my trip to Teachers' College, and asked for a talk on the plan of organization and our methods of work. The Home Economics Department of Cornell University has asked that such a talk be given there also. We feel proud that these universities, which are the foremost in extension work, should be interested in our girls and the results they have achieved.

In our office we have in the last six months written and numbered 3,230 personal letters, making 6,460 per year; and have sent out 46,800 circular-letters.

We have added eleven (11) new counties to our organization for 1915, and have twenty-seven (27) counties which have applied on our waiting list, which we will admit into the organization as soon as we can finance the work.

To carry on the testing of recipes, which, by the way, is done with each recipe before it is given to the girls; and for tests in canning, it is necessary that we have a small laboratory simply equipped for the purpose. This will cost very little, and I hope will be given us.

This work has brought in such fine financial returns that in these times of depression it would seem the part of wisdom to put as much into it as is possible. Our people are beginning to see that at all times wholesome food is a marketable commodity, and that the surplus on their farms may be turned into a substantial income.

Last year our appropriation from State, Federal, and county sources amounted to about $15,000. We have recorded in actual profits, $25,935.74. Respectfully submitted,

JANE S. MCKIMMON,
In Charge, Girls' Demonstration Work.

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Counties.	Girls Reporting.	Tins and Glass.	Sold Fresh.	Money Value.	Cost.	Profit.
Alamance	90	55,165	$ 226.25	$ 7,039.65	$ 1,771.20	$ 5,268.45
Anson	60	38,540	162.16	5,016.20	1,531.80	3,484.40
Buncombe	24	3,407	56.00	320.70	224.96	95.04
Chatham	2	500		110.10	33.00	77.10
Catawba	20	8,007	60.76	1,215.70	275.00	940.70
Cherokee	14	980		200.00	128.80	71.20
Cleveland	38	9,294	19.90	1,399.50	349.60	1,049.90
Craven	5	1,000		105.00	46.00	59.00
Cumberland	7	21,490		448.14	64.40	383.74
Durham	15	4,000	198.00	475.00	138.00	337.00
Edgecombe	27	8,225	215.40	1,147.60	248.40	899.20
Forsyth	28	3,644		610.00	257.60	352.40
Franklin	20	5,500	25.00	650.00	184.00	466.00
Granville	15	1,894		340.00	138.00	202.00
Iredell	69	15,215	137.25	2,147.00	634.80	1,512.20
Johnston	29	5,010	75.00	802.50	225.00	577.50
Madison	43	8,289	10.00	1,382.00	395.60	986.40
McDowell	6	1,858		215.80	55.20	160.60
Mecklenburg	74	6,859	1,105.50	2,230.50	680.80	1,549.70
Moore	28	9,568	25.00	1,077.30	257.60	819.70
New Hanover	8	4,500	122.00	572.00	161.00	411.00
Northampton	11	3,100	20.00	345.00	101.00	244.00
Randolph	20	4,061	36.34	578.34	184.00	394.34
Rowan	12	1,144	219.67	347.87	100.40	247.47
Richmond	17	9,461	91.92	1,351.50	156.40	1,195.10
Sampson	42	20,587	56.50	2,248.80	386.40	1,862.40
Vance	9	2,900	25.00	312.40	82.80	229.60
Wake	20	7,120	30.00	841.80	184.00	657.80
Warren	24	7,475	52.00	808.10	220.80	587.30
Wilkes	53	13,000	50.00	1,350.00	487.60	862.40
Totals	830	259,091	$ 3,019.65	$ 35,688.50	$ 9,704.16	$ 25,983.64

NOTE.—Pender and Guilford counties failed to send in reports.

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APPROPRIATIONS AND DISBURSEMENTS—GIRLS' DEMONSTRATION WORK, 1914-1915.

STATE AGENT AND ASSISTANTS.	Salaries.			
	State.	County (Prospective).	United States.	Total.
Jane S. McKimmon	$ 900.00	$	$ 900.00	$ 1,800.00
M. Scott (10 months)	375.00		375.00	750.00
Evans, field agent (3 months)	225.00			225.00
Leach, field agent (2 months)	150.00			150.00
Clerk (12 months)	840.00			840.00
COUNTY AGENTS.				
Alamance	50.00	250.00	200.00	500.00
Anson	50.00	300.00	400.00	750.00
Buncombe	50.00	300.00	150.00	500.00
Catawba	50.00	500.00	150.00	700.00
Chatham		50.00	100.00	150.00
Cherokee	50.00		50.00	100.00
Cleveland	50.00	200.00	150.00	400.00
Craven	50.00	100.00	100.00	250.00
Cumberland	50.00	100.00	100.00	250.00
Durham	50.00	300.00	150.00	500.00
Edgecombe	50.00	300.00	150.00	500.00
Forsyth		300.00	150.00	450.00
Franklin	50.00	100.00	100.00	250.00
Granville	50.00	250.00	100.00	400.00
Iredell	50.00	250.00	150.00	450.00
Johnston	50.00	100.00	100.00	250.00
Madison	50.00		100.00	150.00
McDowell	50.00	100.00	25.00	175.00
Mecklenburg	50.00	400.00	250.00	700.00
Moore	50.00	350.00	100.00	500.00
New Hanover	50.00	200.00	100.00	350.00
Northampton	50.00	100.00	100.00	250.00
Pender	50.00	100.00	50.00	200.00
Randolph	50.00	100.00	50.00	200.00
Richmond	50.00	200.00	100.00	350.00
Rowan	50.00	100.00	50.00	200.00
Sampson	50.00	200.00	150.00	400.00
Vance	50.00	100.00	50.00	200.00
Wake	50.00	400.00	150.00	600.00
Warren	50.00	200.00	150.00	400.00
Wilkes	50.00	100.00	200.00	350.00
NEW COUNTIES FOR 1914-1915.				
Bertie	50.00	50.00		100.00
Gaston		150.00	100.00	250.00
Pasquotank		100.00	100.00	200.00
Greene	25.00	75.00	50.00	150.00
Wayne		100.00	100.00	200.00
Columbus		100.00	100.00	200.00
Lee		100.00	100.00	200.00
Union		100.00	100.00	200.00
Henderson		100.00	100.00	200.00
Macon		50.00	50.00	100.00
Perquimans	50.00	100.00		150.00
Totals	$ 4,065.00	$ 7,075.00	$ 6,000.00	$ 17,140.00

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APPROPRIATIONS AND DISBURSEMENTS—GIRLS' DEMONSTRATION WORK, 1914-1915.

Traveling expenses of State agent and assistants	$	1,500.00
Canning school in spring, 42 counties organized		700.00
Business meeting in fall		
Enrollment buttons		200.00
Stamps		40.00
Office, Fair exhibit, supplies, and incidental expenses		1,000.00
Expenses	$	3,340.00
Salaries paid from State appropriation		4,065.00
Total amount appropriated by State	$	7,505.00
Total amount appropriated by United States Department		6,000.00
Total amount appropriated by counties		7,075.00
Grand total	$	20,580.00

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REPORT OF THE DIVISION OF AGRONOMY.

MAJOR W. A. GRAHAM,
Commissioner of Agriculture.

DEAR SIR:—I beg to submit herewith the biennial report of the Agronomist of the Department for the period ending December 1, 1914.

During the biennium, by the consolidation of the agronomic work of the Department of Agriculture and of the Experiment Station, it has been made possible to avoid duplication of effort in this branch of activity of the Department and of the Station; and with the same expenditure of money and of time of the workers, it has been possible to accomplish more than could have been accomplished under the former plan of organization, where two separate divisions were maintained.

Considerable time has been devoted by the head of the Division in organizing the work so that each worker would have a specific field. It is felt now that the Division is logically organized, and its work is progressing in a satisfactory manner. The main lines of effort of the Division are as follows:

(1) Soil chemistry.
(2) Soil fertility.
(3) Soil survey.
(4) Plant breeding.
(5) Miscellaneous.

SOIL CHEMISTRY.

For many years it has been felt that a knowledge of the amounts of various plant-food constituents of soil from which the plant must draw its nourishment, coupled with information with reference to the form in which these constituents are held in the soil, would be of the highest importance to the intelligent cultivator of the soil. By taking this information, with that afforded by carefully conducted field tests, much light would be thrown upon the problem of the fertility of any soil. It is along these lines we have been conducting the soil investigations in North Carolina for several years, and it is believed that much progress has been made in solving many of the problems connected with a better agriculture for the State. It should ever be kept in mind that the fertility of our soils is the basis on which the progress of our people is to be made, for when our soils fail to produce remunerative crops, then it will be that all our industries will suffer.

During the past two years a goodly number of chemical and mineralogical analyses of different soils have been completed and tabulated for the piedmont and coastal plain sections of the State. All the samples for these analyses were carefully taken with reference to soil type from areas which had been surveyed and mapped by the soil survey parties. A bulletin giving the results of some of the mineralogical examinations of the

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soils from various areas of the different sections of the State has been prepared and published. It is believed that the matter presented in this bulletin is not only of considerable scientific value, but will be of immense practical value in the interpretation of the field results secured with different crops grown experimentally on different types of soil. Many of the chemical analyses have yet remained unpublished, but these have been brought together for later publication. It is remarkable how closely the field results obtained from the experimental farms agree with the facts brought out by the chemical and mineralogical analyses with reference to the fertilizer requirements of these particular soils. The chemical analyses are of value in determining the total amount of the various elements of plant food which the soil contains, while the mineralogical analyses supplementing the chemical analyses have shown to a great extent the forms in which the plant-food constituents are combined, and have served to explain field results that would be very difficult to understand had not the latter analyses been made. The soils of the mountain and piedmont sections of the State are as a rule much better supplied with potash and lime than are those occurring in the coastal plain section. The amount of phosphoric acid in most of the soils of the State is very low and is the chief limiting factor in crop production on most of the well cultivated land of the piedmont section, particularly.

SOIL FERTILITY INVESTIGATIONS.

These investigations are well organized and are progressing in a very satisfactory manner. They are being conducted on seventeen distinct types of soil in different parts of the State to determine the chief plant-food deficiencies of each of these types.

In the mountain section the studies are being made on four types as follows:

Porter's clay in Transylvania County;
Toxaway silty loam in Cherokee County;
Porter's loam in Buncombe County;
Toxaway loam in Buncombe County.

The experiments on the Porter's and Toxaway loams are located on the Buncombe Test Farm. At this farm there are ninety-six plats devoted chiefly to a study of the fertilizer requirements of these two types of soil for different crops. The results on all of the mountain plats have in a very striking manner shown marked increases from applications of phosphoric acid in available form. Nitrogen, in some cases, has been shown to be a limiting plant-food constituent with those soils that are poorly supplied with organic matter. Generally, in these cases, phosphoric acid is second in importance. Most of the soils, too, have shown some benefit from the use of lime, especially when used in connection with a complete fertilizer. The results in the mountains have shown that a very little if any benefit results from the use of carriers of potash except in the case of some of the leguminous crops, such as red clover.

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In the piedmont section the work at present is confined to a study of the deficiencies of seven of the leading types of soil occurring in that portion of the State. The types under experimentation are as follows:

Cecil clay in Mecklenburg County;
Iredell loam in Mecklenburg County;
Cecil sandy loam in Gaston County;
Cecil clay loam in Iredell County;
Cabarrus silt loam in Union County;
Durham sandy loam in Granville County;
Norfolk coarse sand in Richmond County.

The experiments in Iredell County are located on the Iredell Test Farm. At this farm there are at present 147 different plats devoted largely to a study of the plant-food requirements of this type of soil for different crops grown in rotation on the different plats. The results of the experiments for the piedmont section show that the chief limiting plant-food constituent in plant production is phosphoric acid and, in some cases, nitrogen. Of course, in this section, as for the mountains, where red clover and other legumes are grown, it may frequently be found beneficial to apply potash.

In the coastal plain section the work has thus far covered a study of six distinct types of soil. The experimental fields are located on the following soil types in the counties indicated:

Portsmouth fine sandy loam in Beaufort County;
Portsmouth silt loam in Chowan County;
Norfolk fine sandy loam in Edgecombe County;
Norfolk sandy loam in Pasquotank County;
Norfolk sand in Pitt County;
Muck soil in Currituck County.

The experiments in Edgecombe County are located at the Edgecombe Test Farm, and in all include 155 different fertilizer plats. Most of the plats are devoted largely to a determination of the fertilizer requirements of this particular type of soil. At this farm, as well as at all of the other test farms, a study of not only the plant-food deficiencies of the soil is being made, but the applications to the plats are so arranged that a determination of the best combinations of fertilizers for different crops grown on the particular type of soil; the best carriers of the different plant-food constituents for the different conditions and crops; and also the best methods and dates to apply the fertilizer to the different crops.

The results secured, not only at the Test Farm in Edgecombe County, but also at the outlying farms of the coastal plain, have generally shown that the chief requirement at present for the largest and most profitable yield of the general crops, other than the legumes, is nitrogen. Even with the Portsmouth fine sandy loam type of soil, where the amount of organic matter is large and where we would expect an almost unlimited

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supply of available nitrogen to be present, it has been found that nitrogen for the time being seems to be the limiting factor in profitable crop production. In the case of the Portsmouth silt loam it has been found, however, that applications of phosphoric acid in available form have given much better financial returns than did applications of nitrogen.

At each of the Granville and Rockingham Test Farms there are thirty-six fertilizer plats devoted largely to a study of the fertilizer requirements of tobacco when grown on the soils of these farms. These are the chief soil types for tobacco culture in the State. Some attention is also being given to a study of different carriers of plant food, as well as of the best methods of applying the fertilizer to the tobacco in order to secure not only the highest yield, but product of the highest grade. A study is being made of rotations with the idea of working out those best suited for maintaining tobacco soils in a productive state. In connection with the fertilizer experiments at all the farms, attention is also being given to arranging practical rotations for the chief crops of the various sections.

At the Pender Farm in the spring of 1914 twelve plats were laid out to study the fertilizer requirements of muscadine grapes with and without the growth of cowpeas among the vines. These experiments are conducted in coöperation with the United States Department of Agriculture and the Division of Horticulture of this Department. One of the plats in the series is treated with a mulch of leaves and grass without fertilization, to study the relative effect of this treatment as compared with the other plats receiving different combinations of commercial fertilizers.

SOIL SURVEY.

The soil survey has been conducted in coöperation with the Bureau of Soils, United States Department of Agriculture, along the same general lines as reported in previous years. Two parties have been in the field most of the time and three part of the time. At present there are available good maps of Ashe, Bladen, Buncombe, Cabarrus, Caswell, Chowan, Craven, Duplin, Edgecombe, Forsyth, Gaston, Granville, Henderson, Johnston, Mecklenburg, Mitchell, New Hanover, Pasquotank, Pender, Perquimans, Pitt, Randolph, Richmond, Robeson, Scotland, and Transylvania counties.

A plan has been agreed upon with the Bureau of Soils by which the work will be continued in this State in a systematic way. The work is being pushed as aggressively as funds will permit. Since the last biennial report the Randolph, Forsyth, Bladen, Wake, Union, Rowan, and Lincoln county areas have been finished. Work in Wayne is well under way, and early in the next fiscal year a party is to be sent to Columbus County to survey and map that area.

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PLANT BREEDING.

During the past two years the work in plant breeding has been confined largely to a study of corn, cotton, wheat, oats, cowpeas, soy beans, and rye. For some time a study has been made of varieties of corn best adapted to different portions of the State. It is felt that systematic breeding work should be based, with this crop as with others, upon the selection for starting of the work of seed of the varieties that have shown up as best yielders in the variety tests. It has been found as a result of the past four or five years tests on the different farms that certain varieties have demonstrated their superior value when grown in comparison with other varieties. The best yielders have been found to be: at the Edgecombe Farm, Biggs' Seven-ear, Weekley's Improved, Cocke's Prolific, Goodman's Prolific, and Hickory King; at the Iredell Farm, Weekley's Improved, Southern Beauty, Parker's Prolific, and Biggs' Seven-ear; and at the Buncombe Farm, Biggs' Seven-ear, Southern Beauty, Cocke's Prolific, Hickory King, and Weekley's Improved.

The work with cotton has been largely to determine the relative value of the varieties under test for the different sections, and at the same time make field selections from the superior yielders for breeding work. As a result of tests of a good many varieties during the past ten to twelve years, it has been found that for the soil of the Edgecombe Farm, Shine's Early Prolific, Brown's No. 1, Russell's Big Boll, Sugar Loaf, Cook's Improved, and King's Improved have shown to be the most productive varieties. At the Iredell Farm the best and most profitable yielders are King's Improved, Shine's Early Prolific, Cook's Improved, Russell's Big Boll, Brown's No. 1, and Sugar Loaf, in about the order given. Of the special selections that have been made in the field, it is proposed to make a thorough test of these to determine their relative value as yielders as well as study in a detailed way the quality of the lint and other characters of all selections.

Considerable work with varieties of oats, wheat, and rye at the Buncombe and Iredell farms has been conducted. In this it has been found that of the wheat for both the mountain and piedmont soils, Leap's Prolific, Fulcaster and Poole's are as prolific varieties as has been yet found of the established varieties. With the oats, Appler, Red Rust Proof, for fall sowing, and Burt for spring sowing are probably as suitable varieties as any on the market. Abruzzi rye has given very encouraging results in the way of yield, date of maturity, and the amount of grazing afforded during the winter and early spring. At the Buncombe Farm there were put out this fall seed from 200 head selections of wheat and rye and 68 small plats to increase work with wheat and 18 with oats; and at the Iredell Farm 250 head selections of wheat and rye and 72 plats to increase work with wheat and 52 to oats.

At the Iredell, Edgecombe, and Buncombe farms a series of plats have been started to determine the value of different methods of seeding

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upon yield. A study is also being made of the effect of rate of seeding upon results produced by each of the methods of seeding the grain. At the Iredell Farm there are six plats devoted to a study of the effect of varying dates of seeding upon the yield of wheat. With cowpeas and soy beans, work is being conducted at the Edgecombe, Iredell, and Buncombe farms. It was found in tests conducted during 1913 on wilt-infected soil that the Monetto, Brabham, and Iron varieties of cowpeas were practically free from the disease, while Whippoorwill, New Era, and Groit showed but little infection of the disease. Such varieties as Clay, Wonderful, Taylor, Galavant, and Red Ripper showed 5 to 20 per cent of the plants destroyed when grown under the same conditions as the immune varieties mentioned above.

During the fall of 1913 some coöperative cotton breeding work was started at Aberdeen with one of the progressive farmers of that locality. In this work an effort is being made to produce a high yielding type of long staple cotton suitable for growth on the sandy soils of that section. In the fall of 1913 fifty plants were selected from a general crop of Webber cotton. The seed of each of these plants was grown during the past summer in separate rows and further selections were made during this fall. One of the selected strains gives particular promise of value on account of its earliness, productivity, and uniformity of staple. It is hoped to extend this work to other portions of the State as rapidly as possible.

MISCELLANEOUS.

A large number of individual grasses and grass mixtures have been seeded at the different test farms. These have been put out to study the relative value of each for pasturage and for hay when grown under the various soil and climatic conditions as represented by the different farms. In all, there are more than 200 different plats in this work. On the test farms there are also in operation many culture and tillage experiments with the leading crops of the various sections.

C. B. WILLIAMS,
Agronomist.

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REPORT OF DIVISION OF MARKETS.

MAJOR W. A. GRAHAM,
Commissioner of Agriculture,
North Carolina Department of Agriculture.

SIR:—In accordance with your request, I submit the following report of the work of the Division of Markets, beginning September 21, 1913, the date when this office was first started.

MARKETING SWEET POTATOES.

This State leads all others in the value of the sweet potatoes it produces. The greatest concentration in production occurs in Currituck, Pamlico, Carteret, and Catawba counties. Early sweet potatoes and Irish potatoes are the only money crops in the southern portion of the Currituck peninsula. We listed about 1,600 acres of sweet potatoes and 1,360 of Irish potatoes in a narrow strip of about 20 miles. Many of the growers are interested in organization, but a provision for telegraphic service and the development of better railroad connections will be needed before organization will be feasible. Under present conditions produce dealers in the West find it necessary to buy of other dealers in Baltimore and in other cities, as they cannot rely upon the growers to ship in the amount and at the time needed. Currituck growers obtained as high as $5.50 a barrel gross and $4.61 net for sweet potatoes on July 20, 1914, and as low as $2.50 a barrel gross and $1.85 a barrel net on July 30. During the coming season we hope to secure favorable terms from a distributing agency to contract to take the crop of those growers who will organize to maintain a good standard of grades.

The growers of late sweet potatoes in Pamlico County obtain good prices for their potatoes, but those in Carteret are backward in their methods of marketing. As soon as the necessary help is provided the markets should be watched for these growers, the cost of distribution reduced, and the price increased to the producer. In 1913 these growers received for their late sweet potatoes from 40 to 70 cents a bushel.

THE MARKETING OF NORTH CAROLINA BUTTER.

The creameries outdid all expectations this year, producing by the end of the summer 150,000 pounds a month and piling up a considerable surplus. Production outstripped the marketing facilities.

This office sent out a letter of inquiry to the Southern trade to find out the storage facilities of each community, per cent of butter purchased in tubs, in prints of 1 and of ¼ pounds, etc. According to the replies, the jobbers in all the large cities of Alabama, Florida, and

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Georgia are obtaining no butter and eggs from within their own States, and are receiving 100 per cent of these products from the North and West. It is evident that we have a great market at our door. Our capacity for production of butter and eggs only awaits going after these markets.

MARKETING APPLES.

In an inquiry which we sent out to produce dealers, both North and South, relative to the place of origin of their early Irish potatoes, late Irish potatoes, sweet potatoes, cantaloupes, melons, late cabbages, and apples, it was found that the States to the south of us buy their box apples from the Pacific coast States and their barrel apples mainly from Virginia and New York. Rarely a produce dealer mentions North Carolina. Here again there is great opportunity for expansion if we will go after these markets. A letter was also sent to Southern produce dealers to ascertain the storage capacity available for apples in each city, the storage charges, the varieties and pack preferred. The replies were summarized and sent to the growers. From the growers' end we are determining the proportion of apples which different orchards put in different grades, the prices received for these grades, the differences in price due to spraying or lack of spraying, and net price to grower—that is, gross price paid by the jobbers, minus freight and brokerage charges. The prices which our growers are receiving range from $3.25 gross per barrel for Virginia Beauties, Grade No. 1, and $2.92 net to $2.50 per barrel for Winesaps.

Our competitors, the Virginia Fruit Growers' Organization, will handle 300,000 bushels of apples this season. Of this amount, about 3 per cent will be sold in boxes, a very small per cent in bulk, and the rest in barrels. The organization does not handle unsprayed fruit at all. It cannot do this, says the manager, and keep up its reputation. Thus far there have been 100 cars of apples exported to Liverpool, which sold from $2.40 to $2.60 net. Very few are being exported now on account of the extremely low prices. An effort is being made to place a large proportion of the apples on the market as soon as they are picked; the rest are being stored, principally in Cincinnati, Birmingham, Mobile, Richmond, and Atlanta. Something like 1,500 barrels will be stored in Charleston, W. Va., by the organization. The president already has 800 barrels stored in Wilmington, this State. The leading varieties are Yorks, Winesaps, and a small proportion of Ben Davis. Yorks are used for the export trade.

The Virginia organization itself has a foreign representative to look after the export trade. It also keeps two men on the road drumming up trade in this country. We are sending one man out this year to find markets. As soon as local associations are formed in Waynesville and Mount Airy, as well as in North Wilkesboro, these organizations would be able to look after finding their own markets. Until then we will need

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to get prices for small and large growers to encourage proper methods of spraying, packing, and marketing, and to foster the growth of the industry generally.

RECOMMENDED LISTS OF DEALERS OF FARM PRODUCTS.

About 2,000 dealers in fruits, vegetables, butter, eggs, grain, peanuts, and cotton were listed. The territory covered included States east of Indiana and north of Kentucky, the South Atlantic coast and gulf States. This list, together with the names of the products which each concern handles, was published in the June Market Bulletin. In addition to this general list, this office has published special recommended lists of dealers in potatoes, cantaloupes, melons, cabbages, apples, butter, and eggs.

THE GRADING, WAREHOUSING, AND FINANCING OF COTTON.

The first extended cotton warehouse and cotton financing investigation was started by this office in coöperation with the Office of Markets of the United States Department of Agriculture. After these investigations in this State were finished, the Office of Markets took up the same work in Georgia. The Office of Markets furnished us a specialist in cotton marketing. This office suggested the lines of finance investigation which were pursued in this State and Georgia. The data of these negotiations were used to make an analysis of our warehouse and financial situation relative to the emergency in disposing of this year's cotton crop. Supplementary investigations were made which showed that the farmers and townspeople were responding to the demands of the crisis for more cotton warehouse space brought about by the war. The amount of warehouse space available for the use of farmers increased from a capacity of 88,875 bales to 223,860 bales, exclusive of private and mill storage. The mills, who generally store only for themselves, reported an additional space of 46,100 bales capacity available for the use of farmers.

In the matter of credit the situation is different. The total possible emergency currency which might be available above that already in circulation is only $7,391,586. Only $5,633,912 of this could be based upon warehouse receipts. If $25 on each bale were loaned for 50 per cent of the crop the emergency currency would only be half enough. One hundred and nineteen State banks have reported that the present conditions and the present National legislation is not such that banks can lend farmers sufficient funds to enable them to hold the crop. Still it is evident from these same reports that the farmers, with a very few exceptions, are holding their cotton. The question is, How are they doing it? Many banks state that they are having all they can do to carry old loans. No new loans can be granted, as borrowers are not paying their debts. The farmers are not paying the supply merchants and the supply merchants are not paying the banks. It is the supply merchant, in the first

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instance, who is carrying the farmer. The jobbers, the fertilizer companies, the manufacturers, and finally the local and out of State banks are carrying the supply merchants.

It is evident if the farmers do not sell their cotton this system of credit will have to continue. To cash in would force merchants in the South to the wall. Gradual liquidation of accounts will permit the payment of a larger portion of each obligation. To force immediate liquidation would force the price of cotton down and proportionately decrease the debt-paying power of farmer and merchant alike.

The policy recommended by some banks of making a legal provision for pooling our farm real estate security as a basis for obtaining money should be seriously considered.

Farmers should become depositors of banks in prosperous years, so that they may become borrowers, if need be, in hard times like the present. Bankers usually look after their customers, even when they have not the funds to provide for others. One banker in a tobacco county is able to lend his surplus funds to cotton farmers in another county because the growers were depositing their tobacco money and not hoarding it at home.

Now for the first time the Government has undertaken to show the cotton growers of a county the value of knowing their grades before selling. Ginners with a ginning output of 30,000 bales agreed to go to the trouble of furnishing us samples of each bale of cotton. From these samples the grade is determined and indicated on a card with the same number as that on the bale of cotton. This card is sent to the producer of the cotton. The farmer is charged nothing for this service. He is only required to furnish us with the prices at which he sells his cotton, that we may know the value of the work to him. The cotton grading work is made possible by the coöperation of the Office of Markets, United States Department of Agriculture, the ginners and farmers of Edgecombe County, the Division of Agronomy, and the Division of Markets. It is said that Edgecombe County never knew good middling cotton before this year. On the basis of these grades it has been found possible to sell cotton on different markets at an increase in price. At the same time samples of cotton are being taken from Fayetteville, Scotland Neck, and Spring Hope, in order to determine the price received for the same grades of cotton on the same dates when farmers are not furnished the grade of their cotton. Twenty-five hundred and ten bales of cotton were graded for the farmers of Edgecombe County up to October 31.

Samples of cotton in the seed are also furnished by the ginners from each picking of each farmer. The Division of Agronomy is to determine the tensile strength and the length of fiber of the cotton grown in the county. Better selection of varieties and standardization of types suited to the soil will facilitate the development of an organization for grading and selling cotton.

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COTTON AND COTTON-SEED PRICES IN THE MARKETS OF NORTH CAROLINA.

In accordance with a decision of the Marketing Committee of the Department, this office has been securing reports of prices of cotton and cotton seed from the leading markets of the State. We obtain these reports from fifty towns and send them out weekly to the daily and county newspapers of the State, also to county demonstration agents, county secretaries of the Farmers' Union, and to others who apply for them. Respectfully submitted,

WILLIAM R. CAMP,
Chief, Division of Markets.

WEST RALEIGH, November 16, 1914.

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FINANCIAL STATEMENT.

DECEMBER 1, 1912, TO NOVEMBER 30, 1914.

Balance on hand December 1, 1912	$ 3,700.22
Receipts December 1, 1912, to November 30, 1913	251,402.96
Receipts December 1, 1913, to November 30, 1914	258,703.58
	$513,806.76
Disbursements:	
December 1, 1912, to November 30, 1913	$244,180.27
December 1, 1913, to November 30, 1914	273,057.87
	$517,238.14
Outstanding warrants December 1, 1914	$ 11,939.05
Deficit December 1, 1914	3,431.38
Balance in Treasury December 1, 1914	$ 8,507.67
Drainage advances due	$ 3,855.59

SUMMARY OF DISBURSEMENTS FOR LAST TWO FISCAL YEARS ENDING DECEMBER 1, 1913, AND DECEMBER 1, 1914.

DISTRIBUTION.	1913.	1914.	TOTAL.
EXECUTIVE OFFICE:			
Salaries	$ 9,830.00	$ 9,557.50	$ 19,387.50
Board and committee meetings	2,296.50	2,495.76	4,792.26
Inspection	10,017.42	10,408.19	20,425.61
Tags	5,001.40	4,493.68	9,495.08
Postage, stationery, telephone, etc.	946.15	1,213.61	2,159.76
Freight, express, and drayage	14.07	91.03	105.10
Incidentals	41.25	161.43	202.68
Heat, light, and water	1,098.59	1,828.82	2,927.41
Library and subscriptions	49.25	42.00	91.25
Furniture and fixtures	72.03	180.28	252.31
Traveling expenses	278.06	407.75	685.81
Building and repairs	132.91	234.53	367.44
Building and repairs (special)	507.33		507.33
Contingent	1,121.88	115.50	1,237.38
Publications	10,804.82	11,949.85	22,754.67
Fairs and exhibits	4,330.95	2,901.42	7,232.37
State Fair exhibits	640.19	471.63	1,111.82
Immigration	134.00	309.60	443.60
College notes	20,500.00		20,500.00
Agricultural and Mechanical College (building)		12,500.00	12,500.00
Advances to drainage districts	378.29		378.29
Boys' Corn Clubs	500.00	500.00	1,000.00
Boys' Corn Club buttons		75.00	75.00
Better babies exhibit	82.00		82.00
Rural agricultural libraries		300.00	300.00
Panama Exposition exhibit		1,468.17	1,468.17
Building offices		2,986.41	2,986.41
Buncombe Test Farm	4,849.40	4,441.38	9,290.78

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SUMMARY OF DISBURSEMENTS—CONTINUED.

DISTRIBUTION.	1913.	1914.	TOTAL.
EXECUTIVE OFFICE—*continued*.			
Pender Test Farm	$ 7,602.16	$ 6,065.16	$ 13,667.32
Edgecombe Test Farm	6,308.61	7,196.72	13,505.33
Iredell Test Farm	8,982.76	6,234.15	15,216.91
Washington Test Farm	883.30	6,987.25	7,870.55
Granville Farm notes	6,271.66		6,271.66
Granville Farm expenses	6,261.71	9,227.70	15,489.41
Transylvania Test Farm	1,340.64	1,356.42	2,697.06
ANALYTICAL DIVISION:			
Salaries	21,083.10	22,090.00	43,173.10
Apparatus and reagents	2,959.37	2,707.03	5,666.40
Soil work	4,415.35	5,994.21	10,409.56
Travel	736.42	794.87	1,531.29
Books and periodicals	152.74	200.97	353.71
Stamps and stationery	400.00	492.81	892.81
Telegrams, freight, express, and incidentals	538.19	587.67	1,125.86
Furniture and repairs	92.09	264.33	356.42
Rural survey	500.00	500.00	1,000.00
Fair exhibit		207.96	207.96
FARMERS' INSTITUTES:			
Salaries	3,896.66	4,641.65	8,538.31
Expenses, etc	9,954.31	8,362.06	18,316.37
MULTIGRAPH:			
Salaries		250.50	250.50
Expenses		451.53	451.53
MUSEUM:			
Salaries	4,520.00	4,750.00	9,270.00
Rearrangement (special)		241.49	241.49
Maintenance and improvement	997.45	987.96	1,985.41
PURE FOOD AND OIL DIVISION:			
Salaries	4,450.00	3,917.76	8,367.76
Expenses	999.50	1,374.26	2,373.76
ENTOMOLOGY, DIVISION OF:			
Salaries	5,150.00	4,950.00	10,100.00
Special collections	167.10	59.55	226.65
Field inspection	1,535.00	2,090.76	3,625.76
Office and laboratory	401.70	697.42	1,099.12
HORTICULTURE, DIVISION OF:			
Salaries	6,430.00	6,290.00	12,720.00
Equipment	553.86	692.46	1,246.32
Travel and orchard demonstration	1,454.60	1,695.02	3,149.62
VETERINARY DIVISION:			
Salaries	4,254.98	5,162.20	9,417.18
Sanitary work and travel	1,816.67	2,790.12	4,606.79
Hog serum	9,158.96	11,479.47	20,638.43
Quarantine	8,252.08	12,606.60	20,858.68
BOTANY AND AGRONOMY:			
Salaries	5,415.98	4,898.31	10,314.29
Botany expenses—December, 1912-June, 1913	497.72		497.72
Agronomy expenses—December, 1912-June, 1913	516.01		516.01
Botany and agronomy—June-December, 1913	1,187.36	3,940.65	5,128.01
Help, seed work		150.00	150.00
AGRONOMY:			
Salaries		3,800.00	3,800.00
Expenses		1,400.46	1,400.46
TOBACCO EXPERIMENTS:			
Salary	300.00	300.00	600.00
Expenses	1,994.51	1,352.74	3,347.25

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SUMMARY OF DISBURSEMENTS—CONTINUED.

DISTRIBUTION.	1913.	1914.	TOTAL.
DRAINAGE WORK:			
Salary	$ 600.00	$ 1,300.00	$ 1,900.00
Expenses	611.10	856.90	1,468.00
ANIMAL INDUSTRY DIVISION:			
Salaries	5,681.76	7,050.00	12,731.76
Expenses	7,357.98	13,103.89	20,461.87
COÖPERATIVE DEMONSTRATION:			
Expenses	12,574.02	10,254.22	22,828.24
GIRLS' DEMONSTRATION WORK:			
Expenses	1,000.00	6,556.37	7,556.37
COÖPERATIVE MARKETING:			
Salaries		500.00	500.00
Expenses	296.37	4,062.73	4,359.10
Totals	$ 244,180.27	$ 273,057.87	$ 517,238.14

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THE BULLETIN

OF THE

NORTH CAROLINA

DEPARTMENT OF AGRICULTURE,

RALEIGH.

Vol. 33, No. 6. SUPPLEMENT, JUNE, 1912. Whole No. 169.

CORN CULTURE

IN

NORTH CAROLINA

PUBLISHED AND SENT FREE TO CITIZENS ON APPLICATION.

Entered at the Post-office at Raleigh, N. C., as second-class matter, February 7, 1901, under Act of June 6, 1900.

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*Assigned by the Bureau of Soils, United States Department of Agriculture.
†Assigned by the Bureau of Plant Industry, United States Department of Agriculture.

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TABLE OF CONTENTS.

	PAGE
Corn Soils of the State	5
Black Lands	5
Gray Soils	5
Red Soils	6
Mountain Soils	6
Preparation of Seed Bed	7
Green Manuring—"Souring" of Soil	7
Plowing	8
Seeding the Cover Crop	9
Spring Preparation	10
Conservation of Moisture	10
Selection and Preparation of Seed	11
Breeding Plat	12
Preservation	13
Germination Test	13
Fertilization	14
Planting	15
Date of Planting	15
Depth of Planting	16
Thickness of Planting	16
Cultivation	17
Harvesting	17
Rotations	19
Corn Judging	21
Score-card	22
Varieties and Variety Tests	24
Best Variety	31
Corn Production in North Carolina	31
Corn Yields in North Carolina	32
Corn Yields by Counties	32
Sources of Seed Tested in 1911	34

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LETTER OF TRANSMITTAL.

SIR:—I have the honor to submit herewith a manuscript on Corn Culture in North Carolina. This is a short general treatise on the subject of corn culture in the State and includes the variety test work done by the Agronomy Division of this Department during 1911. This is intended as a companion bulletin to "Cotton Culture in North Carolina," both of which were formerly combined and issued under one cover. I recommend the publication of this manuscript as a supplement to the June BULLETIN of this Department. Respectfully,

J. L. BURGESS,

Agronomist.

HON. W. A. GRAHAM,

Commissioner of Agriculture,

Raleigh, N. C.

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CORN CULTURE IN NORTH CAROLINA.

CORN SOILS OF THE STATE.

Perhaps every farmer who has a field or a farm rich in organic and mineral matter, and not subject to overflow or too retentive of moisture, feels that he has a good corn soil, and so he has. It has been aptly and wisely said that when it comes to growing corn there is "more in the man than there is in the land."

Nevertheless, there is not an experienced farmer in the State who does not have his choice of soils for corn production. While any good farmer can grow a fair crop of corn, even on the sandhill region of the State, still, with the same effort, the same farmer can grow a much larger crop of corn on the Toxaway loam, the Cecil clay, the Norfolk fine sandy loam, the Portsmouth fine sandy loam, or the black lands of Hyde and Beaufort counties.

THE BLACK LANDS.

There are no better corn soils in the United States than are the black fine sandy loam, muck, and peaty soils of Hyde, Beaufort, Washington, and other of the coast counties. These deep, black, peaty lands have been for thousands of years in process of formation from the intermingling of decaying vegetable matter with the fertile leachings brought down by the streams from the more elevated areas of the State. Not only so, but in the prehistoric lagoonal areas, that now underlie these peaty lands, swarmed myriads of fishes and crustacea that left their remains in the form of marl beds which now furnish lime for various agricultural purposes throughout this section. Thousands of acres of these black soils are already under cultivation and large drainage enterprises are yearly opening up thousands of additional acres for the growing of corn, soja beans, potatoes, etc. Here we have the highest average corn yield in the State, which has made this section famous for its corn crop.

THE GRAY SOILS.

Organic matter and well-drained land are prime requisites to successful corn growing in North Carolina. As we proceed westward from the eastern counties we find the soils growing more sandy and lighter in color, due to the evident lack of vegetable matter.

But one will be surprised to see the large crops of corn grown on this relatively poor soil by the liberal use of cowpeas, crimson clover, vetch, soja beans, etc., plowed under as green manure, supplemented by a limited amount of commercial fertilizer. The former furnishes needed organic matter which in itself supplies nitrogen and renders available

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quantities of otherwise inert mineral plant foods inherent in the soil itself. The latter adds plant food and corrects certain deleterious soil conditions.

Practically the whole of the coastal plain lying between the eastern black-land district and the lower piedmont section is covered by the gray sandy soils. Robeson County produces more corn than any other county in the State, and it is composed almost entirely of the gray sandy loam lands. The leading corn-soil types found in this section are the Norfolk fine sandy loam, the Norfolk sandy loam, and one or two members of the Portsmouth series.

THE RED SOILS.

Lying to the westward of the gray-soil region we find a large development of red lands. Some of these have red soil and red subsoil. They grade in texture from sandy loams to clay loams and clays. Most of these soils belong to the Cecil series, though not an unimportant area is comprised in the strong corn soils of the Mecklenburg group.

All of these soils, like the gray lands of the coastal plains section, will do their best only in the presence of liberal amounts of vegetable matter. These red lands are generally well suited to the growth of red clover, tall meadow oat, orchard and some other grasses, and produce highest yields of corn when these grass and clover sods have been plowed under the previous fall or winter.

YELLOW AND DARK SOILS OF THE MOUNTAINS.

In the mountain section corn does especially well in the bottom-lands of the New, the French Broad, and the Swannanoa rivers, along which deep, rich deposits composed of fine sand, silt, and clay, intermingled with organic matter and soluble fertilizing materials washed from the mountain-sides, have been laid down during the annual flood seasons. The Porter's loam and clay loam of the uplands produce good corn when properly handled, but the leading corn lands of this region are found in the Toxaway soils along the above-named streams.

The Toxaway soils are generally of a dark color, due to the presence of large amounts of organic matter. The surface is generally level to gently rolling, a characteristic of alluvial soils everywhere. Where poorly drained, tiling is generally feasible. They are subject to overflow, but this fact does not deter the farmer from pitching his crop on them, because, in spite of the susceptibility to overflow, good crops are nearly always grown on these rich bottom-lands.

The Porter's soils of the uplands usually have a yellowish colored soil and subsoil, the latter frequently grading into a reddish-brown color. Though generally steep-sided, fields of this soil do not erode so rapidly as one not accustomed to these mountain lands would imagine. The rains soak rapidly into the soil and break out at lower levels as mountain springs. Clover and grass do exceptionally well on these lands, and when corn is grown in a rotation with these crops good yields are obtained.

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PREPARATION OF SEED BED.

As pointed out above, practically all the corn soils of the State except the black lands of the east will profit by the addition of liberal amounts of some cheap form of organic matter. Perhaps the cheapest form in which humus can be obtained is that of green manures and crop residues. Next to this in cheapness is stable manure, of which 90 per cent of the farmers have little more than enough for their gardens and a light top dressing for a small part of their wheat lands. Too much stress cannot be laid on the importance of organic matter in our corn lands, for without it our commercial fertilizers must fail to do the maximum amount of good and our crop yields must remain below the point of profitable production.

Organic matter will do more for our heavy soils than any number of plowings. It makes the land mellow and friable; it loosens up the texture; it changes the color and increases its capacity to absorb and retain heat; it permits the soil bacteria to convert the millions of pounds of nitrogen in the air into nitrates ready to be consumed as food by the growing crops; it absorbs and retains moisture better than anything else we can add to the land; it enables the micro-organisms of the soil to convert the mineral plant-food elements into soluble and available forms and holds them suspended in its capillary spaces throughout the entire soil stratum, ready to be absorbed by the rapidly developing rootlets of the growing vegetation; it renders clayey soils so open and porous that they are seldom too dry to plow or too wet to till. Humus is the life blood of the soil; therefore, let us add to the richness and volume of this life blood.

CORRECT METHOD OF HANDLING GREEN MANURE—"SOURING" THE SOIL.

We hear a great deal about the "souring" of land by the too liberal use of green manure, and many farmers are afraid to use it to any extent on this account.

The real explanation of this "souring" effect lies, generally, in the method of handling the green manuring crop, and not in the subsequent development of an excess of organic acid in the soil.

The crop is generally plowed down with a good, strong team, hitched to a big plow on which is fastened a chain for the purpose of enabling the plowman to "wrap up the vines" and bury them deep enough to be out of the way of subsequent cultivation. This places a layer of very porous vegetable matter some two or three inches thick, say eight inches under the surface. The crop is then planted and cultivated over this bed of vegetable matter, and if the season is at all dry the farmer is likely to lose his crop. Why? If the farmer should examine this vegetable matter some weeks after it was plowed under, and when his crop is looking worst, he would find the soil just under this bed of vines, etc., almost as wet as mud, while the soil just above it would likely be as

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dry as dust. This, then, is the explanation of the "souring" effect of green manure as generally handled: The rain water goes rapidly down through the soil and through the layer of vegetable matter and is stored in quantities in the subsoil, but this bed of noncapillary vegetable matter entirely cuts off the rise of this moisture from the subsoil to supply that taken from the surface soil by evaporation and plant growth. There has been a mechanical and not a chemical condition set up in the soil that cuts off the water supply from the plants and causes them to starve for water in spite of a normal rainfall.

The remedy is apparent. See that the vegetable matter is cut fine by the disc harrow before it is plowed under, and, when plowing, edge the furrow slice and thus incorporate the vegetable matter with the soil and have it uniformly distributed throughout the soil stratum from top to bottom. The moisture can then move down and up in the soil to meet the needs of the crop throughout the season. It is always observed, on well-drained land, that the following year, when the land has been plowed deeply again, the layer of vegetable matter torn up and mixed with the soil, that the "souring" effect disappears, showing, if rightly interpreted, that it was the localization of the vegetable matter and not an excessive development of organic acid that produced the deleterious effect.

Care must be taken not to turn under organic matter too deeply in heavy soils, since the processes of decay go on very slowly below ten or twelve inches. It has been found that the microflora, bacteria, etc., that cause the organic matter of the soil to decay, and thus give rise to the formation of the various nitrates in the soil, do not act freely below nine or ten inches under the surface of heavy soils.

It is also true that these all-important organisms cannot exist in the first two or three inches of the surface soil on account of the too great aëration and drying effect of the sun's heat. Their greatest activity, therefore, is confined to that part of the soil stratum lying between three and ten inches of the surface.

Now, these bacteria feed almost exclusively on organic matter. An important by-product of cattle feeding is the manure produced, but the principal produce of the feeding of the bacteria is the formation in the soil of natural nitrates which are fundamental to crop production and which are immediately available for the plant as soon as formed. If we cut off the food supply from our cattle, they die, and the same is true when we cut off the food supply from our soil bacteria. It will be seen, moreover, that the proper feeding of the soil bacteria is thus fundamental to the feeding of cattle or any other farm animals.

PLOWING.

Land intended for corn should generally be plowed in the fall and sowed to some cover crop, as crimson clover, vetch, burr clover, or rye, to be turned under in the spring for green manuring purposes.

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Of course, the advisability and the possibility of fall plowing will depend upon the rotation practiced. In case corn follows cotton it will be obviously impossible to plow the land in the fall in time to sow a cover crop for green manure. Under the circumstances it will generally be better to sow the cover crop in the cotton some time in September or the latter part of August and let it get a good start before the hard freezes of winter come. A crop sown thus early will make a much better, more thrifty, and earlier growth in the spring than one sown just before cold weather sets in.

In the spring the green crop, together with the old cotton stalks, should be thoroughly cut to pieces with a sharp disc harrow and plowed under some six or eight inches deep. Spring plowing of heavy soils is rarely advisable when the rotation will admit of fall plowing unless the land needs an annual application of some cheap form of organic matter to improve its physical condition.

Rotations in which corn followed wheat, oats, or clover and grass, the land can, and generally should be, fall plowed and sowed to some cover crop.

Where a heavy clover and grass sod is to be turned under the plowing should be done rather late in the fall, say after the first killing frost, when the various insect pests have done depositing eggs. Late plowing of these sod lands, after vegetation has ceased to grow and furnish hiding places for the eggs of insects, will destroy great numbers of the eggs and larvæ of these pests and rid the land the next season of the great army of cut-worms and wire-worms that usually infest cornfields on land that has been seeded down to meadow or pasture for a few years. It will generally be unnecessary to put a cover crop on newly broken sod lands, as the soil is supposed to be full already of organic matter in the form of clover and grass roots.

SEEDING THE COVER CROP.

We have heard a great deal said about the winter cover crop; that it kept the soil from washing, added humus, and conserved the soluble nitrates. Now, the cover crop will do all these things, and more, only in case it is sowed early enough to make some growth in the fall.

It will be recalled that plants take up and conserve plant food only while they are growing. It will be remembered, also, that these winter cover crops make little or no growth between November and April, during which time no soluble food left over from the crop of the previous season is being taken up and conserved. Moreover, when the cover crop is sown late no material growth occurs before spring, and not only is the object of conserving plant food defeated, but the soil is thus allowed to wash as badly as if no crop had been sown, due to the fact that the small plants have not had an opportunity to develop a sufficiently large root system to bind the soil particles and hold them in place. It is obvious, therefore, that the cover crop should be sown early

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enough to permit it to make considerable growth before the dormant period sets in; otherwise, much of its benefit will be inevitably lost.

SPRING PREPARATION.

There is little gained by planting corn very early in the spring. Thorough preparation of the land is entirely essential for best results, and this preparation can hardly be given when corn is planted between March 15th and April 15th. More thorough preparation and later planting is good advice to follow.

The disc harrow should be used on fall plowed land as early in the spring as soil conditions will permit in order to loosen up and aërate the surface. The disking may take the place of plowing in some cases, when the land should be disked some two or more times, with the diskings some ten to fifteen days apart. After the last disking the land should be gone over with a smoothing harrow in order to break and pulverize any clods and smooth the surface preparatory to planting.

When corn land is well prepared the crop is half cultivated, and this first half of the cultivation can be much more easily and economically given before the crop is pitched. Keep the harrow going and kill all germinating weeds and grasses, and do not fear that half your crop will be lost if you do not get it planted before May 15th.

When it is necessary to plow land in the spring the plowing should be done as early as practicable in order to conserve moisture, and as late as possible in order to give the green manuring crop, except in case of rye, a chance to make a large vegetative growth to be turned under.

The green manuring crop, together with the old cotton or corn stalks, should be thoroughly cut to pieces with a sharp disc harrow before plowing under. When plowing, the furrow slices should be edged and not inverted. If it is not too late in the season, the land should be left in this rough plowed condition until after a good rain, when it should be thoroughly disked and let lie for a week or ten days. Just before planting the land should be gone over with a smoothing harrow as outlined above.

In case spring plowing must be done on land without the green manuring crop the harrow should follow closely behind the plow, because every farmer knows moist clods pulverize more easily than hard, dry clods. Again, the more completely the clods are pulverized the better the soil mulch forms and, consequently, the more moisture will be conserved for the crop.

CONSERVATION OF MOISTURE.

The necessity for the conservation of moisture has been stressed as much in the above discussion of the preparation of the seed bed as though a group of farmers were being addressed in the arid West. Why lay so much emphasis on this point when our lands are more frequently too wet than too dry? Why conserve moisture in a State with over fifty inches rainfall?

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The reason is still within the memory of North Carolina farmers. What farmer has forgotten the spring and summer of 1911? What farmer in piedmont North Carolina does not remember nearly every July and August since he began farming? The early drought of 1911 cut the corn crop short throughout that part of the State lying east of the mountains and west of the black-land section of the east.

In the piedmont section proper, the midsummer drought is of regular occurrence, and yet most farmers fail to make proper and effective preparations for combating it. In this section the corn crop grows off rapidly and encouragingly until the fruiting stage is reached, when the midsummer drought is almost sure to set in and cut the yield down about half. Practically every farmer in this section has had the yield of a field that promised to make fifty bushels per acre cut down to fifteen bushels per acre by the midsummer drought. It is worth while, then, to emphasize the importance of moisture conservation in the piedmont section especially, and farmers on the gray-soil belt of the coastal plain will do well to keep this in mind, also, as their corn crops are not entirely exempt from the withering effects of our August suns.

The disastrous effects of the midsummer droughts can be almost wholly offset by the proper conservation of soil moisture in the early spring months, which must be effected through the incorporation with the soil of liberal amounts of vegetable matter; deep fall plowing; early spring plowing; thorough disking and harrowing before planting; and proper cultivation of the crop after planting.

SELECTION AND PREPARATION OF SEED.

A task well begun is half done. Obviously, the most important part in beginning the task of growing a corn crop is the selection of good seed. Now, there are two kinds of good seed. There is a good variety seed and a good vitality seed. It is needless to say that however good may be the variety we select, our crop will be a failure if the vitality of the seed we plant is not strong enough to give us a good stand. It is, therefore, more important for us to have good viable seed for planting than to have a good variety to plant, in case we cannot get both qualities in the same sample.

Did you ever select your seed corn from the crib in the spring? Yes. Then it is safe to assume you picked out the finest looking ears you could find. I suppose most of us would do that. But how many ears like the ones you chose for seed were borne on a single stalk—two, three, or four? The chances are that in ninety-nine cases out of a hundred not more than one such ear as you chose for seed was borne on a single stalk last year. Why? Because the high yielding, prolific cornstalks do not bear big, showy ears. The ears produced by these plants and these varieties are generally medium to small.

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By thus selecting your seed in the crib you accelerate the tendency of your corn to grow one ear to the stalk, and thus reduce the yield per acre.

No corn grower should think of making crib selections of seed for planting. In the fall, when the husks are turning brown on the ears, the farmer should search his fields for such plants as he would be glad to grow the following season. He will not find a great many such plants, but he will find a few, and these he should select and carefully tag for seed. The plants must not be cut or have the fodder pulled from them at all. Let the stalks dry up and the ears cure out thoroughly before taking them in from the field.

BREEDING PLAT.

Select enough of these ideal plants for the crop next season and reserve a number of the best of these carefully selected ears for the breeding plat.

The breeding plat should be on land similar in all respects to the land on which the general crop is to be planted. In this plat plant some fifty or one hundred rows of fifty to one hundred hills each from the best ears selected in the field from the general crop, and fertilize and cultivate just as you would the rest of the corn crop.

It is a well-established fact that seed corn that has been crossed makes a better yield and a better quality of corn than seed that has been inbred. You must, therefore, select from this breeding plat only such ears as have been rigidly crossed.

In order to insure rigid crossing in the seed patch you have only to resort to the simple operation of detasseling every other row or every other hill, leaving tassels in the two outside rows.

Do not pull the fodder from the breeding plat, but let the stalks dry up and the ears remain in the field till they have dried out thoroughly. Now go into the breeding plat and select your seed corn for the next crop. Take only the best ears from the best stalks. It would be well, however, to make a careful examination of the plat before the stalks dry up, in order to note any tendency to disease among the stalks. Those stalks showing susceptibility to any of the common diseases of corn should either be cut out at once or so marked that ears will not be taken from them for seed at gathering time. Be sure that every ear selected for seed the following year is taken from a detasseled stalk. Not a single ear, no matter how beautiful it may be, should be taken from a stalk in which the tassel has been allowed to grow.

Enough corn should be selected from this breeding plat to plant the general crop, but the very best ears in the plat should be kept for the breeding plat the following year. Always plant the very best selections in the breeding plat and save the rest for the general crop. You will thus gradually increase the general strength and vigor of your whole

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crop by concentrating your efforts on a small area from year to year with a view to increasing the vitality and prolificacy of the strain.

PRESERVATION.

Having thus carefully and scientifically selected your seed corn, the next step is the proper care and attention given its preservation till planting time. The best and most viable seed corn may have its germinating power greatly reduced by improper handling and storing during the winter months.

The first essential in the preservation of seed corn is a dry place. After having been allowed to dry out thoroughly in the fall, the ears should be carefully stored in a dry place where rats cannot get at them and where the corn weevil is not likely to bother. Seed corn should by no means be stored in an open crib or a damp cellar.

On one occasion, "Four bushels of corn were harvested and divided into two equal parts. One part was well dried and kept dry during the winter in a seed-house and the other kept in an ordinary corncrib. . . . On rich bottom-land, the well-preserved seed produced 18 bushels more per acre than the cribbed seed; while, on poor upland, the well-preserved seed produced 7 bushels more per acre than the cribbed seed. The cribbed seed germinated as well as the well-preserved seed, but the resulting plants were less thrifty and less productive." *

It is thus highly important that the seed corn be kept with great care through the winter months.

GERMINATION TEST.

Every farmer wants to know what per cent of his corn is capable of coming up, before he puts it into the ground. Some weeks before planting, therefore, the seed corn should always be put through the germination test. This may be done in different ways. Each ear may be shelled separately and ten grains put in moist soil or on moist blotting paper and kept in a warm place till they sprout. Note carefully how many of these ten grains, taken at random, make a good, vigorous germination, sending out both root and leaf. Another method allows all of the seed corn to be shelled and a sample of one hundred grains taken at random and put in the test. In the first case the number of grains germinating multiplied by ten will give the per cent of germination secured. For example: if six grains out of the ten make a good germination, this would equal a germination of 60 per cent. In the latter case the actual number of grains in the hundred that germinated would represent the percentage of germination secured. Note carefully the strength and vigor of germination, since some grains have enough vitality to barely germinate, but not enough to make much farther growth. It is much better to make a germination test of each ear, as by this method you

*Bulletin 414, U. S. Department of Agriculture.

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can pick out and discard any that have low vitality, whereas this could not be done if all the ears were shelled together.

FERTILIZATION.

The corn crop is a gross feeder. You cannot make the land too rich for corn. The high individual acre yields that have been produced in the South in recent years have been grown on rich land—land heavily loaded with some form of organic matter to which varying amounts of certain available commercial fertilizers were added.

All the corn soils of the State, except the black, mucky soils of the far east and the very limited area of bottom-lands along the principal streams, are in need of organic matter as a basis of economical fertilization. It is but a shortsighted policy that puts large amounts of commercial fertilizer under the corn crop when the soil is bleached for lack of humus. It must always be borne in mind that large amounts of some cheap and easily obtained organic matter lies at the very foundation of successful corn growing in North Carolina. Some few of our lands are well supplied, and this supply must be kept up; but the vast majority of them do not have more than a tenth as much as normal crop requirements demand, and to these nine times the present amount must be added.

But where shall we get the needed organic matter for these soils? Ask the average farmer in the South, and he will at once say, "Feed stock and get stable manure for the soil." Ask him if he has done this, and he will say no. Ask him why he has not taken his own advice, and he is marooned, and admits that such advice is "more blessed to give than to receive."

The fact of the matter is that no farmer has ever yet taken a piece of poor land and grown enough feed and forage on it to feed enough stock to make enough manure to bring it up. The following question has been put to a great number of North Carolina farmer audiences, "Let every man who has produced feed and forage enough on a fifty- to a hundred-acre farm of average fertility in North Carolina to feed enough live stock to make enough stable manure to bring the land up to a high state of cultivation hold up his hand." Not a hand has gone up so far. Some farmers, by purchasing forage from their neighbors and cotton-seed meal, bran, shorts, etc., from the merchants, have brought large tracts of land up to a high state of fertility. This practice is commendable in so far as it can be followed. But how is Mr. Jones going to maintain the fertility of his soil if he sells his hay and crop residues to Mr. Smith as forage for his live stock? Some one has said that where one farm has been raised to a high state of fertility by live-stock farming, ten adjacent farms have been lowered in crop-producing power. It is a favorite saying of Mr. B. W. Kilgore that animals destroy fertility and in no sense conserve it. Dr. C. G. Hopkins, whose

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authority no one will question, says: "In nearly all sections of the country a farmer can be found here and there—sometimes one in ten, and sometimes only one in a hundred—who feeds all the crops that he raises and also all that he can buy at reasonably low prices from his neighbors, who supplements all this with more or less purchased bran, shorts, oil meal, cotton-seed meal, etc., and who is thus able to produce sufficient manure of good quality to maintain or even to increase the fertility of his own farm at the expense of many other farms; but no extended State or Nation ever has or ever can maintain sufficient live stock, even in country and city combined, to furnish manure with which to maintain the productive power of all the farm lands."

Where, then, shall we get this vegetable matter in cheap form on which to build up our corn lands? It is evident that our source must be adequate to supply not a few favored farmers, but every tiller of soil in the State. The only source of humus that can be drawn on so extensively is green manures and crop residues, supplemented, it may be, with stable manure. Red clover, crimson clover, burr clover, hairy vetch, soy beans, rye, oats, old corn and cotton stalks—anything that will rot in the ground is good and can be used by every farmer in the State as a source of organic matter in the growing of the corn crop.

Once the foundation for economical fertilization is laid, the additional fertilization for the corn crop is likely to be found quite simple. A large percentage of fertilizers used at present may be either discarded altogether or their use will be found vastly more remunerative. In other words, the present yields can be greatly increased with less fertilizer than is used at present, and any increased amount will be used only in case the use shows greatly increased production, which is likely to be the case when the soil contains large amounts of humus.

In the piedmont and mountain sections phosphate is likely to be the leading element in the mixture, while in the sandy gray soils of the coastal plains potash is apt to be found of leading importance. But the relative amounts, the proper combinations, the methods of application, etc., must be worked out for each leading soil type of the State, and this is now being done by the Agronomy Division of this Department.

PLANTING.

DATE OF PLANTING.

The best time for planting corn will vary with the locality. In general, it is better to defer planting in favor of thorough preparation of the seed bed than to rush the seed into the ground while it is yet cold and damp from the winter freezes. A good warm seed bed is very essential to the prompt germination and rapid early growth of the corn plant, and this condition cannot be obtained when the crop is planted too early. Again, early planted corn is generally more subject to the depredations of cut-worms and other insect pests, especially when planted on sod land, than when planted later.

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DEPTH.

Early planted corn should not be planted so deep as that planted later in the season, since early in the spring the ground is cold and germination is more sluggish. As the season advances the depth of planting may be increased.

When the seed bed has been properly prepared, furrows should be run some five to six inches deep, leaving four to five inches of loose, finely pulverized soil between the bottom of this furrow and the unbroken subsoil beneath. In the bottom of this furrow the corn should be planted, but covered shallow. Corn is generally planted too near the surface, especially in the piedmont section, where the midsummer drought is most prevalent. Here the corn should have its root system develop rather deeply in order to come in contact with better and more lasting moisture conditions. When a large amount of green vegetation has been cut up and incorporated with the soil it is highly necessary that the crop be planted deep below the surface (but covered shallow) in order to escape the drying effects of the first three to four inches of the surface soil during the first two or three weeks of the season. Then, too, the root system gets a thorough hold of the deeper soil and gradually, as the season advances, rises to the upper soil and finally occupies the whole soil stratum, thus utilizing all the available plant food present. Of course, corn must not be planted too deep, but a small amount of careful observation and a little experimentation on a given soil will enable the farmer to judge very closely of the proper depth of planting for best results. The more deeply planted corn does not grow off so rapidly, as a rule, but withstands the midsummer drought better and yields more corn in the fall.

THICKNESS OF PLANTING.

The thickness of planting will vary with the variety and the fertility of the soil. It will be borne in mind that the high individual acre yields that have been made in the South during the past two or three years were not made so much by the increased prolificacy of the individual stalks as by the increased number of stalks per acre.

On account of the irregularity of our fields the checking of corn by means of the check-row planter is never likely to become general. The crop is now generally planted in the drill and, so far as we know, there is no economic necessity for changing this time-honored method.

The drilling of the crop gives the opportunity for proper spacing in the row; the thickness of planting can be regulated to a nicety. Experiments seem to indicate that one stalk in a hill with hills close together gives better results than the same number of stalks per acre with, say, two stalks in a hill. That is, it is better to have the stalks twelve inches apart and one in a hill than to have the hills three feet apart and three stalks in a hill.

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CULTIVATION.

Before the corn comes up the weeder or smoothing harrow should be run over the field to break the crust and destroy any germinating weeds and grasses. The use of the weeder may be continued till the corn is several inches high and thus save considerable of the expense of cultivation.

When the corn is too large for the weeder, a light running cultivator should take its place and the surface kept carefully mulched till the crop is safely beyond the possible injury of the midsummer drought.

Most farmers "lay corn by" too soon. In the piedmont section, in particular, where the midsummer drought is especially severe, it is not uncommon to see corn "laid by" at tasseling time, when a drought of four to six weeks may set in; and a crop that promised fifty bushels per acre may be cut down to a yield of fifteen bushels. It must be borne in mind that one of the primary objects of the cultivation of corn is the conservation of moisture. It must also be remembered that at tasseling time the corn plant is taking up and using more soil moisture and plant food than at any other time in its history. Now is the time the crop needs the farmer most, as the results of the work of the whole season may depend on a few final harrowings at this critical period in the growth of the plant. Now is the time to conserve moisture in order to mature the crop that is already on the land. What folly, then, to "lay by" our crops and abandon them to their fate just at the time they need us most and when a few extra workings will add so enormously to our final harvest! Some one has advised to "cultivate the corn crop till the silk is dead on the end of the shoot," and this is not bad advice. *Cultivate shallow, frequent, and late,* is a motto that every farmer can safely adopt.

HARVESTING.

There have been rapid strides in the improvement of methods of getting the corn crop off the land during the last ten years in the South. Every farmer remembers the twenty-two different operations necessary to get the corn crop off the land preparatory to sowing wheat in North Carolina twenty years ago.

First the tops were cut, tied into bundles, loaded on the wagon, hauled to the barn, and stored away in the barn loft. Then the fodder was pulled from the remainder of the stalk, tied into bundles, loaded on the wagon, hauled to the barn, and stored away in the loft. The corn was then pulled, thrown on the ground in piles, loaded on the wagon, hauled to the barn, unloaded in a long heap, husked and thrown into the wagon, hauled to the crib and there stored away. The cornstalks were then cut, put into piles and burned, making even twenty-two handlings of the corn crop after it was matured.

But now, with the advent of the corn binder, a harvesting machine that can be operated by one man and two good horses, the crop is cut

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and bound at one operation; the bundles are then set up in shocks and allowed to dry out; when dry, the shocks are loaded on the wagon and hauled to the shredder, where, at one operation, the corn is husked and loaded into a wagon and the stover blown into the barn loft or other receptacle. The ears are then cribbed. The whole crop being thus removed from the land with but six operations—less than one-third the number formerly required.

By another method, which is even more commendable than either of the two from the standpoint of soil fertility, the farmer husks the ears on the stalk and throws them into the wagon at one operation; hauls the corn to the crib and unloads it; then cuts the stalks, fodder, and all to pieces with a stalk cutter, and the land is ready for plowing, making just four operations, as against twenty-two with the first named method.

In the South much corn that has been shocked after the western method rots before it can be shredded or otherwise housed from the weather. We are sometimes tempted, perhaps, to ape western methods without fully understanding western conditions. There is no question but that if stock is to be fed with stover as roughage, the corn crop should be cut up and shocked after the manner of the corn-belt farmer. It is but criminal waste of time and physical energy for the cattle feeder to "cut tops" and "pull fodder" after the old methods practiced in the South.

But it must be borne in mind that climatic conditions in Iowa and Illinois are different in the fall from what they are in North Carolina. There the falls are *cool* and *dry;* here they are warm and nearly always wet. There the drought comes in the fall; here it comes in midsummer. There corn shocks may stand in the field till spring without injuring the corn or materially reducing the feeding quality of the stover; here both corn and stover are likely to be ruined by Christmas. There the corn shocks are made of from three to five medium-sized bundles and opened wide at the base so the air can quickly and easily circulate through them; here the shocks are generally of haystack proportions, closely compacted throughout, in order, it would seem, to exclude the air and promote fermentation—a condition that so nearly always follows as to make the spoiling of shocked corn in this region the rule rather than the exception. Our farmers are, therefore, afraid to cut and shock corn lest they lose both corn and stover by rotting in the shock.

But this condition can be remedied, to a great extent, by reducing both the size of the bundles and the size of the shocks. The corn should be cut when the husk is beginning to yellow or turn brown and the grains have become dented and glazed. The shocks should be set up as soon as the binder has passed, and opened out wide at the bottom in order to allow the air to circulate freely through the base and middle of the shock. Not more than three bundles should ever be placed in one shock in the South. Just as soon as the shocks have dried out they

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should be hauled and shredded or otherwise placed under shelter. Frequent examinations should be made of the shocks to see when they are dry enough to take in out of the weather. Do not let November find the corn shocks still in the field, because much of both corn and stover is likely to be rotten by this time. In a word, then, make small shocks, thoroughly aërate them, and get them in out of the rain as soon as possible, and you will have little trouble with your corn harvested in this manner.

ROTATIONS.

It is, at once, to our advantage and our detriment that the climatic conditions in this latitude cause the humus of our soils to burn out with great rapidity. With us oxidation of organic matter is far in excess of normal accumulation of organic matter; while in the North and West the terms are largely reversed, that is, normal accumulation of organic matter is equal to or exceeds oxidation, and there is, therefore, a gradual increase of vegetable matter in the soils from year to year, especially when the land is not run continuously in a clean culture crop.

This rapid burning out of the vegetable matter of our soils is to our advantage, in that it enables the growing crop to get more plant food from our soils in an equal space of time, and thus makes it possible for us to produce larger acre yields, than the relatively richer but less active black soils of the corn belt. With our soils well supplied with rich humus, therefore, there is no question but that we can grow more corn per acre than the farmer located on the colder corn lands of Ohio and Iowa. But, with the humus content of our lands reduced to a minimum, our crop yields must also be brought below the point of profitable production, and herein lies the danger attending the rapid oxidation of our soil humus.

There are a number of rotations that can be followed in the production of the corn crop. In general, no rotation should be adopted that does not provide a liberal yearly supply of organic matter for the soil. As a rule, rotations should be short. In some cases corn may be successfully grown after corn for a number of years in case cowpeas and crimson clover are sown in the field at "laying by" time and plowed under before the next crop is pitched. In this case the old cornstalks, cowpea vines, and green clover should all be thoroughly disked to pieces before plowing under in the spring.

On the sandy soils of the coastal plain region a rotation of cotton, corn, and oats may be practiced to advantage. Here the cotton should be followed by rye and crimson clover sown in late summer or early fall and plowed under for corn in the spring. The corn may have the peas sowed with it at the last cultivation and when the corn is pulled or cut the peavines and corn stubble may be thoroughly disked and the land sowed to winter oats. When the oats are cut in June the land should be sowed to cowpeas, which should be cut for hay and the land seeded to crimson clover to be plowed down for the following corn crop.

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SUGGESTED ROTATION FOR CORN CULTURE IN NORTH CAROLINA ON SANDY SOIL OF COASTAL PLAINS REGION.

No. I.

First year	Cotton	Corn	Oats.
	Rye	Cowpeas	Cowpeas.
	Crimson Clover		Crimson Clover.
Second year	Corn	Oats	Cotton.
	Cowpeas	Cowpeas	Rye.
		Crimson Clover	Crimson Clover.
Third year	Oats	Cotton	Corn.
	Cowpeas	Rye	Cowpeas.
	Crimson Clover	Crimson Clover	

Farther up in the piedmont section on the sandier soils, where cotton and corn are of about equal importance, rotation No. II may be found profitable. This is one of corn, cotton, and oats, or wheat, as local conditions may demand. By this rotation crimson clover may be sown in the cotton either at the last cultivation or after the first or second picking. This clover should be plowed under in the spring preparatory to planting corn. Cowpeas should be planted in rows between the corn rows, and oats or wheat sowed after the corn stubble and peavines have been thoroughly disked to pieces and plowed under. When the small grain is cut the land may be plowed and sowed to peas, which may be cut for hay and the land seeded to rye and crimson clover to be plowed under for cotton the following year.

SUGGESTED CROP ROTATION FOR CORN CULTURE IN NORTH CAROLINA ON THE SANDY SOILS OF THE PIEDMONT SECTION.

No. II.

First year	Cotton	Corn	Oats or Wheat.
	Crimson Clover	Cowpeas	Cowpeas.
			Crimson Clover.
			Rye.
Second year	Cotton	Oats or Wheat	Corn.
	Crimson Clover	Cowpeas	Cowpeas.
		Crimson Clover	
		Rye	
Third year	Oats or Wheat	Corn	Cotton.
	Peas	Cowpeas	Crimson Clover.
	Crimson Clover		
	Rye		

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On the heavy loam clay and clay loam soils of the piedmont and mountain sections rotation No. III is recommended in the production of the corn crop. In this rotation wheat is sown in the fall and red clover is sown in the spring on the fall-sown grain and allowed to occupy the land that year and the year following. In the fall of the following year, after the first crop of clover has been cut for hay, the second crop, bearing the seed, should be turned under for corn the following year. Wheat may follow corn in the fall and the cycle repeated.

SUGGESTED CROP ROTATION FOR CORN CULTURE IN NORTH CAROLINA ON RED SOILS OF PIEDMONT AND YELLOW SOILS OF THE MOUNTAIN SECTIONS.

No. III.

First year	Wheat	Clover	Corn.
Second year	Clover	Corn	Wheat.
Third year	Corn	Wheat	Clover.

CORN JUDGING—SCORE-CARD.

It has been well said that the highest and only purpose of the corn judge is to give first rank to that sample which, in his estimation, is capable of producing more corn of better quality than any other sample on exhibition.

But on what basis does the judge make his decision? "At the great corn exhibit at the Chicago Exposition in 1886, five expert judges worked some days in preparing a scale of points to guide them in their decisions."* This was the first use of the score-card. Since then a number of States have adopted score-cards which seemed best suited to the corns grown by the farmers in their different localities.

The purpose of the score-card should be to convey to the mind the essential points to be considered in examining an ear, sample, or an exhibit of corn; to impress the relative value of these points; to explain their exact meaning, and show why they mean so much.

Many changes have been made in the original score-card, and still we question whether it has been correlated with the farmer's practice in a way to be of the most benefit to him.

A properly constructed score-card should be a criterion by which to judge not only the sample of corn at the corn show, but, through this sample, the real progress made by the farmer in actual corn production.

The following suggested score-card for North Carolina conditions is submitted in the hope that it may bring out some points not hitherto properly stressed in corn-judging contests.

*Corn (Bowman and Crossly), page 406.

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SUGGESTED SCORE-CARD FOR NORTH CAROLINA.

Uniformity of exhibit	5
Trueness to type	5
Prolificacy	15
Shape of ear	2
Purity	5
Butts	3
Tips	20
Space between rows	10
Dimensions of ear	2
Uniformity of grain	3
Per cent of corn to cob	20
Viability	10

Uniformity of Exhibit.—The ears must all be as nearly the same length as possible. The ears may be short or they may be long, as regards the standard length of the variety exhibited, but they must all be of the same length. If some of the butts are poor, let them all be poor alike, or let them all be good alike. If the variety is white, let all the ears be perfectly white, and do not exhibit a lot of corn of mixed color unless this mixture of color is characteristic of the variety. Let the exhibit present a rounded whole and not an irregular mixture of varieties and types.

Trueness to Type.—If a cylindrical ear is the type, let all the ears be cylindrical. If the type of ear is one that naturally tapers, see that all the ears in the lot taper.

Prolificacy.—It is generally conceded that the prolific corns produce more bushels per acre than the one-ear varieties, and for this reason it would seem advisable to encourage the growth of these higher yielding strains. Other things being equal, therefore, an exhibit of a prolific variety of corn will generally take the premium over a nonprolific. In our score-card we have, therefore, allowed fifteen points for prolificacy.

The prolific corns always bear comparatively small ears, but the exhibit should contain the largest ears that can be found in the crop of the prolific variety grown. The contestant must not exhibit nubbins, but well-grown ears of the variety and of good shape and soundness.

Purity.—This refers more especially to the breeding of the variety. If the variety has white cobs, there must not be an occasional red cob in the exhibit. If the corn is white, the ears must not have an occasional red, yellow, or blue grain, but all the grains on all the ears must be white. If the variety has a smooth dented ear, the exhibit must not contain ears with rough dented, chaffy grains, but all grains on all ears must have the same general characteristics.

Butts.—The contestant must be very careful to see that ears with well-filled butts are selected. A poorly filled butt shows lack of proper pollination, which may be transmitted and become a serious defect in the variety.

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The butts should have uniformity in size and shape. Do not select ears with swelled butts, as these generally have lost rows, that is, rows that start but do not extend to the tip of the ear, and have irregular, crumply grains.

Tips.—We must emphasize the importance of well-filled tips, because this quality of ear, much more than that of the filling of the butts, is under the direct control of the farmer.

If the tips show lack of pollination, the indications are that the pollen had ripened and gone before the silks had come out from the tip grains; in other words, the variety has a tendency to be proterandrous. This tendency can be overcome by carefully selecting for seed only those ears having well-filled butts and tips.

Some varieties of corn seem to have a natural tendency to pointed tips, but when pointed tips occur in a variety which normally produces cylindrical ears there is something wrong either with the season or the method of cultivation. Frequent, shallow, and late cultivation which conserves great stores of soil moisture will generally fill the tips with well-grown and well-developed grains. When the latter part of the season has been too dry or the crop has been "laid by" too soon, the grains decrease in size from butt to tip from the dimensions of normal grains of the variety to those of popcorn; while with normal seasons, or late cultivation, the grains are nearly as large within an inch of the tip as they are within an inch of the butt. We are inclined, therefore, to score twenty points for well-filled tips on account of the bearing it has on the cultivation of the corn crop.

Space Between Rows is generally influenced by the manipulation of the crop in the field. Pulling the fodder and cutting the tops frequently cause a shrinkage in the grains, and the weight of the ears are thus reduced. In order, then, to discourage the pulling of the fodder, which is a very poor forage at best, and thus increase the acre yield of corn in the State, we have given ten points in favor of the absence of excessive space between rows except in those varieties, like Hickory King, in which large space between the rows is a variety characteristic. The reduction of the space between the rows increases the amount of corn that may be shelled from the cob.

Dimensions of Ear refers to the length of the ear and circumference of the ear measured about midway from butt to tip. The relative dimensions are generally reckoned at one to three-fourths. That is, the circumference should generally be about three-fourths of the length. To illustrate: if the ear is ten inches long the circumference would normally be about seven and one-half inches about midway of the ear. The dimensions are important mainly in aiding the exhibitor in securing uniformity in his exhibit, and is, therefore, given but two points in the score-card.

Uniformity of Grain is important not only in imparting a pleasing appearance to the exhibit, but is very essential in planting the crop with

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the modern corn-planting machinery. Grains of irregular shape do not plant well and are liable to lack uniformity in germinating power. Uniformity of grain is a factor that can be largely controlled by persistent selection of seed ears with uniform grains, but since the farmer has, perhaps, less control over this than many other characteristics of the ear, we have allowed but three points for uniformity of grains.

Per Cent of Corn to Cob, together with prolificacy, determines largely the acre yield of the variety. A high per cent of corn to cob requires a deep grain and a relatively small cob. An effort should be made to have the variety shell out at least 90 per cent of corn to cob. The present standard is, of course, only 80 per cent, making 70 pounds of ears shell out 56 pounds of grain when the corn is air dry.

It is not easy to say just what proportion the depth or length of grains should bear to the diameter of cob, but a number of measurements of what seemed to be ideal ears revealed a proportion of one to eight-tenths. That is, the diameter of the cob midway between butt and tip measured eight-tenths as much as two of the grains laid end to end. It is likely to be found that the best proportion of length of grain to diameter of cob will run about one to three-fourths, the same as the proportion of length to circumference of ear. This proportion of depth of grain to diameter of cob bred into the leading prolific varieties will greatly increase the acre yields over the State.

The per cent of corn to cob is so very important and so completely under the control of the corn breeder that twenty points are given to this factor in the score-card.

Viability is the power the individual grains have to germinate and grow. An exhibit of corn that possesses good viability is sound, mature, clean, and in good market condition. The corn judge lays considerable stress on soundness and market condition, as these factors determine the final disposition of the product. Ten points have been given this factor in the score-card.

Some corn shows exhibit a great many different kinds of corn and fail to classify them. It is not unusual to find nonprolifics, prolifics, white, red, yellow, blue, speckled, soft, flint, deep grained, and shallow grained varieties, as well as pod corns and popcorns, all exhibited under the same class. Here the judge is evidently put in a position where an intelligent decision under the circumstances is impossible.

Every distinct variety should be placed and judged in a class by itself, that is, the prolific corns should be placed in a class to themselves; the nonprolifics in a class to themselves, the yellow corns in a class to themselves; the popcorns in a class to themselves, etc., and premiums and awards made accordingly.

VARIETIES AND VARIETY TESTS.

We can never hope to get any one best variety of corn for all our different soil types and climatic conditions, but must expect each of the

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three or four geographic divisions of the State to develop and require varieties and strains of corn suited to their own peculiar conditions of soil and climate.

There are hundreds of different commercial varieties and strains of corn in the United States to-day. A number of these commercial varieties have distinguishing characteristics, while many of them have not, but are the same variety listed under different trade names for commercial purposes only. This is, of course, unfortunate, as it serves only to confuse the farmer and causes him, many times, to buy seed corn that he otherwise would not have bought had he known just what the would-be new variety represented. There are, however, a number of good and distinct varieties of corn in North Carolina grown by men of the highest integrity and put on the market under such trade names as will not confuse the buyer. Among these are Biggs' Seven-ear, Goodman's Prolific, Cocke's Prolific, Weekley's Improved, Hickory King, Farmer's Favorite, and a number of others.

In the case of live stock, each breed or strain is developed to meet some special need or demand; so, also, in plants, in general, a variety is the result of a definite set of environmental conditions that have combined to produce the variations that go to make the new strain. The variety, then, is the result either of changed natural conditions or of effect along lines carefully laid with a view to adapt and adjust strains of plants to new environmental conditions. The variety thus developed is, in the nature of the case, adapted to the surroundings where it has been making its best yields.

In the case of corn the mere existence of corn varieties carries with it the suggestion that they are not all equally well suited to all climatic and soil conditions, and that each one has, doubtless, proven to be the best variety tested in its native locality. We are to assume, then, that these are all good corns when grown under favorable soil and climatic conditions. Again, since varieties of plants are generally developed in a given locality under given soil and climatic conditions, it follows that they will make as good, if not better, yields when propagated under soil and climatic conditions similar to those under which they have been developed. Now, if there be a probability that varieties of corn will make better yields in their native environments than elsewhere, it follows that the adaptability of the many different varieties put on the market should be tested. If any of them are well suited to the climate and soils of our State it is worth our while to know it. Should they not be adapted to our conditions, such knowledge is a necessary protection against loss. The only way to gain this knowledge is to subject these corns to a rigid test on our soils. The recommendations of the seedmen are frequently unreliable, since they never know whether the environment in which the variety has been developed is similar to the one in which it will be forced to grow.

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With a view to protect the farmer against the frauds of unscrupulous seedmen and originators on the one hand, and to ascertain the varieties best suited to the soils of the State on the other, the State Department of Agriculture began several years ago to collect corn varieties from different parts of the country, and to subject them to a rigid test on the recognized corn soils of the State. Since then over sixty different varieties have been collected and tested—some for longer, others for shorter periods.

The reader will bear in mind that in any given year all of the varieties tested were subjected to identical soil and climatic conditions at different points in the State and received identical treatment as to cultivation, fertilization, and previous preparation of land.

In 1911 the Department put out varieties of corn at a number of points in the State, covering several different soil types. Table No. I shows the results of the work done at the Iredell Test Farm at Statesville. Here the five highest yielders were Weekley's Improved, Southern Beauty, Snowflake, Poole, and Batts' Four-ear, in the order named; while the five lowest yielding varieties were Shenandoah White Dent, Marlboro Prolific, Goodman's Prolific, Henry Grady, and Crook's Prolific, in the order named.

Table No. II shows the results of the work at the Edgecombe Test Farm at Rocky Mount. Here the five highest yielding varieties were American Queen, E-1, Southern Beauty, Biggs' Seven-ear, and Goodman's Prolific, in the order named; while the lowest yielders were Henry Grady, Shenandoah White Dent, Snowflake, Blount's Prolific, and Cocke's Prolific, in the order named.

In addition to the variety work done on the Test Farms, a number of test experiments were made locally at different points in the State. Table No. III shows merely the yield in bushels per acre secured at the different points. In these tests Biggs' Seven-ear stood at the top, with Eureka holding it a close second. The table is self-explanatory, but it will be interesting to note that all the varieties made rather high yields and that the yields of the same variety were very different at different points in the State. Biggs' Seven-ear made less than thirty bushels at Jackson, but over seventy bushels per acre at Tarboro. These differences are due both to soil type and irregularities in soil fertility.

Table No. IV shows the compiled results of the variety test work done at the Edgecombe Farm 1909 to 1911 inclusive. Here the highest yielding varieties during this time were Biggs' Seven-ear, Hickory King, and Southern Beauty, in the order named.

Table No. V shows the compiled results of the tests made at the Iredell Farm during the same period. Here Southern Beauty, Weekley's Improved, and Parker's Prolific were the three highest yielders.

Table No. VI shows an average yield of two years at the Buncombe Test Farm. The three highest yielders on this farm during 1909 and 1910 were Southern Beauty, Hickory King, and Biggs' Seven-ear.

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No. I—VARIETY TEST OF CORN AT IREDELL TEST FARM IN 1911.

Varieties.	Stalks Per Plat.			Yield Per Plat.		Yield Per Acre.		Pounds of Ears to Shell One Bushel.	Shelling Capacity.		Total Weight.		Pounds Stover Per Acre.	Weight of Measured Bushel of Shelled Corn.	Rank According to Yield.
	For Perfect Stand.	By Actual Count.	Barren Stalks.	Pounds of Ears.	Pounds of Stover.	Pounds of Ears.	Bushels of Shelled Corn.		Per Cent Grain.	Per Cent Cob.	Per Cent Ears.	Per Cent Stover.			
Weekley's Improved	218	218	....	146	160	2920	38.9	75	81.3	18.7	47.7	52.3	3200	61	1
Southern Beauty	218	218	2	128.5	123	2570	38.3	67	85.0	15.0	51.0	49.0	2460	57	2
Snowflake	218	218	1	128.5	133	2570	37.5	68.5	82.4	17.6	49.1	50.9	2660	56.5	3
Poole	218	218	....	133	117	2660	37.4	71	85.9	14.1	53.2	46.8	2340	61	4
Batts' Four-ear	218	218	....	134.5	150	2790	36.9	75.5	81.4	18.6	48.1	51.9	3000	61.5	5
Cooke's Prolific	218	218	1	138.5	125	2770	36.4	76	80.2	19.8	44.1	55.9	2500	61	6
Boone County	218	218	2	115	100	2300	35.1	69.5	81.2	18.8	53.4	46.6	2000	56.5	7
Hickory King	218	218	....	114.5	145	2290	34.6	66	86.3	13.7	44.1	55.9	2900	57	8
Blount's Prolific	218	218	1	133.5	114	2670	34.6	77	81.1	18.9	53.9	46.1	2280	62.5	8
Parker's Prolific	218	218	....	126	127	2520	34.0	74	81.0	19.0	49.8	50.2	2540	60	9
Lippard's Improved	218	218	3	118	155	2360	33.7	70	84.2	15.8	43.2	56.8	3100	59	10
American Queen	218	218	1	126	131	2520	33.6	75	82.6	17.4	49.0	51.0	2620	62	11
One-ear Corn	218	218	1	110	168	2200	33.3	66	83.3	16.7	39.5	60.5	3360	55	12
Eureka	218	218	3	125	168	2500	32.8	76	78.9	21.1	42.6	57.4	3360	60	13
Columbia Beauty	218	218	1	116	111	2320	32.6	71	83.0	17.0	51.1	48.9	2220	59	14
Indian Twin	218	218	7	127	135	2540	32.5	78	80.1	19.9	48.4	51.6	2700	62.5	15
Biggs' Seven-ear	218	218	....	120	135	2400	32.4	74	81.0	19.0	47.0	53.0	2700	60	16
White Majestic	218	218	3	113.5	134	2270	32.4	70	83.5	16.5	45.8	54.2	2680	58.5	16
Crook's Prolific	218	218	....	116	145	2320	32.2	72	77.7	22.3	44.4	55.6	2900	56	17
Henry Grady	218	218	11	106	193	2120	32.2	66	81.8	18.2	35.4	64.6	3860	54	17
Goodman's Prolific	218	218	....	113	135	2260	31.8	71	87.3	12.7	45.5	54.5	2700	62	18
Marlboro Prolific	218	218	3	117	140	2340	31.2	75	81.3	18.7	45.5	54.5	2800	61	19
Shenandoah White Dent	218	218	3	99	108	1980	27.8	71	82.1	17.9	47.8	52.2	2160	58.5	20

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No. II—VARIETY TEST OF CORN AT THE EDGECOMBE TEST FARM IN 1911.

Varieties.	Yield Per Plat.		Yield Per Acre.		Pounds of Ears to Shell One Bushel.	Shelling Capacity.		Total Weights.		Pounds Stover Per Acre.	Weight of Measured Bushel of Shelled Corn.	Rank According to Yield Per Acre.
	Pounds of Ears.	Pounds of Stover.	Pounds of Ears.	Bushels of Shelled Corn.		Per Cent Grain.	Per Cent Cob.	Per Cent Ears.	Per Cent Stover.			
American Queen	100.5	154.5	2010	27.9	72	83.3	16.7	39.4	60.6	3090	60	1
One-ear Corn	96.5	103.5	1930	27.9	69	82.6	17.4	48.2	51.8	2070	57	1
Southern Beauty	87	88	1740	27.6	63	85.7	14.3	49.7	50.3	1760	54	2
Biggs' Seven-ear	101	104	2020	26.5	76	80.2	19.8	49.2	50.8	2080	61	3
Goodman's Prolific	87	93	1740	26.3	66	86.3	13.7	48.3	51.7	1860	57	4
Batts' Four-ear	95	95	1900	26	73	79.4	20.6	50	50	1900	50	5
Eureka	94.5	160.5	1890	25.9	73	79.4	20.6	37	63	3210	58	6
Cooke's Prolific	91	74	1820	25.6	71	81.6	18.4	55.1	44.9	1480	58	7
Hickory King	79	106	1580	24.3	65	86.1	13.9	42.7	57.3	2120	56	8
White Majestic	82.5	147.5	1650	24.2	68	83.8	16.2	35.8	64.2	2950	57	9
Parker's Prolific	85.5	59.5	1710	23.4	73	79.4	20.6	58.9	41.1	1190	58	10
Columbia Beauty	79.5	80.5	1590	23.3	68	82.3	17.7	49.6	50.4	1610	56	11
Crook's Prolific	79	66	1580	23.2	68	76.4	23.6	54.4	45.6	1320	52	12
Marlboro Prolific	87.5	97.5	1750	22.7	77	80.5	19.5	47.2	52.8	1950	62	13
Poole	74	51	1480	21.7	68	82.3	17.7	59.2	40.8	1020	56	14
Indian Twin	81	64	1620	21.6	75	80	20	41.5	58.5	1280	60	15
Boone County	75	120	1500	21.4	70	80	20	38.4	61.6	2400	56	16
Weekley's Improved	80.5	79.5	1610	20.6	78	71.7	18.3	50.3	49.7	1590	56	17
Blount's Prolific	76	79	1520	20.5	74	81	19	49	51	1580	60	18
Snowflake	68	87	1360	19.7	69	81.1	18.9	43.8	56.2	1740	56	19
Shenandoah White Dent	63	112	1260	17.5	72	79.1	20.9	36	64	2240	57	20
Henry Grady	14	196	280	4.4	63	82.5	17.5	6.6	93.4	3920	52	21

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No. III—LOCAL EXPERIMENTAL VARIETY TESTS.

Varieties.	Location.						Average Yield Per Acre.	Rank According to Average Yield.
	Jackson.	Goldsboro.	Elizabeth City.	Tarboro.	Brevard.	Rutherfordton.		
	Yield in Bushels Per Acre.							
Biggs' Seven-ear	29.7	23.4	29.5	72.2	46.7	32.7	39.0	1
Eureka	22.2	20.1	34.5	58.4	68.7	24.8	38.1	2
Batts' Four-ear	21.7	20.4	35.7	58.4	55.0	26.0	36.2	3
Henry Grady	18.8	22.8	29.1	60.4	60.5	23.7	35.8	4
E-1	21.4	21.3	35.3	54.5	57.7	23.7	35.6	5
Southern Beauty	24.2	19.5	28.7	47.9	63.2	26.5	35.0	6
American Queen	25.1	15.9	31.6	55.8	55.0	25.1	34.7	7
Boone County	18.2	16.8	35.9	42.7	66.0	28.5	34.6	8
Goodman's Prolific	22.2	21.3	34.9	50.9	55.0	23.1	34.5	9
White Majestic	24.2	14.7	38.4	42.7	60.5	23.7	34.0	10
Snowflake	21.7	21.0	33.6	46.0	55.0	23.1	33.8	11
Crook's Improved	18.0	15.6	32.4	57.1	55.0	24.2	33.7	12
Columbia Beauty	22.8	15.6	32.3	50.6	55.0	24.8	33.5	13
Shenandoah White Dent	18.2	15.3	31.6	47.3	63.2	25.1	33.4	14
Parker's Prolific	20.8	16.2	26.6	53.8	57.7	25.7	33.4	14
Indian Twin	23.1	20.4	29.9	47.7	49.5	26.8	32.9	15
Blount's Prolific	20.5	17.4	31.2	49.9	52.2	22.8	32.3	16
Marlboro Prolific	19.1	21.3	29.1	46.0	52.5	24.5	32.0	17
Poole	21.4	18.6	32.6	39.4	55.0	22.0	31.5	18
Hickory King	18.2	24.9	25.5	42.7	52.2	23.4	31.1	19

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No. IV—COMPILED RESULTS OF VARIETY TEST OF CORN—EDGECOMBE TEST FARM.

Varieties.	1909.		1910.		1911.		Averages for Three Years.	
	Yield of Shelled Corn in Bushels Per Acre.	Rank in Productivity of Shelled Corn in Test of This Year.	Yield of Shelled Corn in Bushels Per Acre.	Rank in Productivity of Shelled Corn in Test of This Year.	Yield of Shelled Corn in Bushels Per Acre.	Rank in Productivity of Shelled Corn in Test of This Year.	Average Yield of Shelled Corn Per Acre.	Rank According to Productivity.
Biggs' Seven-ear	41.5	1	31.9	2	26.5	3	33.3	1
Hickory King	30.0	13	35.5	1	24.3	8	29.9	2
Southern Beauty	27.2	21	31.3	3	27.6	2	28.7	3
Weekley's Improved	40.7	2	23.3	15	20.6	17	28.2	4
Parker's Prolific	15.6	31	26.0	8	23.4	10	21.6	5
Boone County	13.7	32	25.1	10	21.4	16	20.0	6
Henry Grady	28.2	16	24.8	11	4.4	21	19.1	7
Goodman's Prolific	31.5	10	23.6	13	26.3	4	17.1	8

No. V—COMPILED RESULTS OF VARIETY TEST OF CORN—IREDELL TEST FARM.

Varieties.	1909.		1910.		1911.		Averages for Three Years.	
	Yield of Shelled Corn in Bushels Per Acre.	Rank in Productivity of Shelled Corn in Test of This Year.	Yield of Shelled Corn in Bushels Per Acre.	Rank in Productivity of Shelled Corn in Test of This Year.	Yield of Shelled Corn in Bushels Per Acre.	Rank in Productivity of Shelled Corn in Test of This Year.	Yield of Shelled Corn Per Acre.	Rank According to Productivity.
Southern Beauty	30.4	5	39.4	1	38.3	2	36.0	1
Weekley's Improved	26.5	14	38.4	2	38.9	1	34.6	2
Parker's Prolific	34.2	1	35.2	6	34.0	9	34.4	3
Boone County	31.0	3	32.8	8	35.1	7	32.9	4
Hickory King	21.5	30	32.1	9	34.6	8	29.4	5
Biggs' Seven-ear	26.0	17	29.5	16	32.4	16	29.3	6
Goodman's Prolific	24.2	22	31.7	11	31.8	18	29.2	7
Henry Grady	23.4	23	29.3	17	32.2	17	28.3	8

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No. VI—COMPILED RESULTS OF VARIETY TEST OF CORN—BUNCOMBE TEST FARM—BOTTOM-LAND.

Varieties.	1909.		1910.		Averages for Two Years.	
	Yield of Shelled Corn in Bushels Per Acre.	Rank in Productivity of Shelled Corn in Test of This Year.	Yield of Shelled Corn in Bushels Per Acre.	Rank in Productivity of Shelled Corn in Test of This Year.	Yield in Bushels of Shelled Corn Per Acre.	Rank According to Productivity.
Southern Beauty	24.0	9	42.3	1	33.1	1
Hickory King	25.7	5	38.3	4	32.5	2
Biggs' Seven-ear	25.2	7	37.5	5	31.3	3
Boone County	25.5	6	37.2	7	31.3	3
Cocke's Prolific	25.2	7	35.8	10	30.5	4
Williams'	23.3	11	36.8	8	30.0	5
Weekley's Improved	21.4	15	36.6	9	29.0	6
Parker's Prolific	19.2	21	34.8	12	27.0	7
Goodman's Prolific	16.2	23	34.6	18	25.4	8

THE BEST VARIETY TO USE.

In case care has been taken in the selection and adaptation of the seed, we unhesitatingly say the best variety for you to use is the one you have developed on your own farm. By adaptation we mean the growing of the same variety on the same kind of land for a sufficient length of time to allow it to become adjusted to its soil and climatic surroundings.

The varieties of corn that have given good results in the piedmont section for the past several years are Weekley's Improved, Southern Beauty, and Cocke's Prolific.

Those that have done well in the coastal plains section are Cocke's Prolific, Biggs' Seven-ear, Southern Beauty, and Hickory King.

CORN PRODUCTION IN NORTH CAROLINA.

A glance at the following tables will show the acreage, production, average acre yield, and market value of the corn crop of North Carolina from 1900 to 1910 inclusive.

It will be noted that the acreage has gradually increased from not quite 2,500,000 acres in 1900 to over 3,000,000 acres in 1910. The total yield has also increased from not quite 30,000,000 bushels in 1900 to over 57,000,000 bushels in 1910. The farm value of the crop has likewise increased from not quite $17,000,000 in 1900 to nearly $43,500,000 in 1910.

Table No. VIII shows the distribution of corn production over the State by counties. Robeson County leads the State in total yield with

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SOURCES OF SEED TESTED IN 1911.

Variety.	*Source.*	*Address.*
Weekley's Improved	N. C. Department of Agriculture	
Southern Beauty	L. A. Stroup	Tobaccoville, N. C.
Snowflake	T. W. Wood & Sons	Richmond, Va.
Poole	J. C. Poole	Marion, N. C.
Batts' Four-ear	J. F. Batts	Garner, N. C.
Cooke's Prolific	N. C. Department of Agriculture	
Boone County	T. W. Wood & Sons	Richmond, Va.
Hickory King	A. O. Lee	Hickory, Va.
Blount's Prolific	T. W. Wood & Sons	Richmond, Va.
Parker's Prolific	T. B. Parker	Raleigh, N. C.
Lippard's Improved	R. Lippard	Statesville, N. C.
American Queen	T. W. Dalton	Crits, Va.
E-1	Coker Brothers	Hartsville, S. C.
Eureka	T. W. Wood & Sons	Richmond, Va.
Columbia Beauty	T. W. Wood & Sons	Richmond, Va.
Indian Twin	H. T. Macon	Warrenton, N. C.
Biggs' Seven-ear	Noah Biggs	Scotland Neck, N. C.
White Majestic	T. W. Wood & Sons	Richmond, Va.
Crook's Improved	Crook Brothers	Huron, Tenn.
Henry Grady	W. G. Headen	Austell, Ga.
Goodman's Prolific	J. K. Goodman	Mount Ulla, N. C.
Marlboro Prolific	Excelsior Seed Farm	Cheraw, S. C.
Shenandoah White Dent	T. W. Wood & Sons	Richmond, Va.

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THE BULLETIN

OF THE

NORTH CAROLINA

DEPARTMENT OF AGRICULTURE

RALEIGH

Volume 34--No. 2. FEBRUARY, 1913. Whole No. 180

VARIETY TESTS OF CORN

SENT FREE TO CITIZENS ON APPLICATION.

Entered at the Postoffice at Raleigh, N. C., as second class matter, February 7, 1901, under act of June 6, 1900.

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*Assigned by the Bureau of Soils, United States Department of Agriculture.
†Assigned by the Bureau of Plant Industry, United States Department of Agriculture.

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LETTER OF TRANSMITTAL.

February 1, 1913.

Hon. W. A. Graham,
Commissioner of Agriculture.

Sir:—I have the honor to submit herewith a manuscript, covering the corn variety test work of the Cereal Section of the Agronomy Division during 1912, and respectfully recommend its publication as the February Bulletin of this Department.

J. L. Burgess,
Agronomist.

Approved for publication:
W. A. Graham, *Commissioner.*

CONTENTS.

	Page
What an acre of corn may yield	4
Selection and preparation of seed	4
Breeding plat	5
Preservation of seed	5
Germination test	6
Planting	6
Date of planting	6
Depth of planting	6
Thickness of planting	7
Thinning to a stand	7
Varieties and variety tests	8
The best variety to use	16
Sources of seed tested in 1912	16

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WHAT AN ACRE OF CORN MAY YIELD.

With rows four feet apart, and corn planted eighteen inches apart in the row with one stalk in the hill, an acre of corn will contain 7228 stalks. With each stalk bearing one ear, there will be produced 7228 ears of corn per acre. If but one ear per stalk is grown that ear should not weigh less than twelve and one-half ounces, thus giving the farmer 90,350 ounces of ear corn. There are 1,120 ounces in one bushel of ear corn. Therefore, if we divide 90,350 by 1,120 we will get about 80.6 bushels as the amount of shelled corn that may be grown on an acre of ground under ideal conditions with a one-ear variety of corn.

Should the farmer grow two 12.5 ounce ears per stalk his yield will, of course be doubled. Again should he reduce the distance between hills to nine inches and also grow two 12.5 ounce ears per stalk, he will multiply his original yield by four, or produce over three hundred and twenty bushels per acre.

Of course this is far above the highest limit yet reached, or, indeed, is ever likely to be reached, but a yield of over two hundred and thirty bushels per acre has already been produced and the contest is still on.

The important point to be noted in this connection is that the eighty bushel yield cannot be made unless the stand is practically perfect. Therefore, the factors which operate in producing the perfect stand must receive the most careful consideration. First among these is the

SELECTION AND PREPARATION OF SEED.

A task well begun is half done. Obviously, the most important part in beginning the task of growing a corn crop is the selection of good seed. Now, there are two kinds of good seed. There is a good variety seed and a good vitality seed. It is needless to say that however good may be the variety we select, our crop will be a failure if the vitality of the seed we plant is not strong enough to give us a good stand. It is, therefore, more important for us to have good viable seed for planting than to have a good variety to plant, in case we cannot get both qualities in the same sample.

Did you ever select your seed corn from the crib in the spring? Yes. Then it is safe to assume that you picked out the finest looking ears you could find. I suppose most of us would do that. But how many ears like the ones you chose for seed were borne on a single stalk—two, three, or four? The chances are that in ninety-nine cases out of a hundred, not more than one such ear as you chose for seed was borne on a single stalk last year. Why? Because the high yielding, prolific cornstalks do not bear big, showy ears. The ears produced by these plants and these varieties are generally medium to small. By thus selecting your seed in the crib you accelerate the tendency of your corn to grow one ear to the stalk, and thus reduce the yield per acre.

No corn grower should think of making crib selections of seed for planting. In the fall, when the husks are turning brown on the ears, the farmer should search his fields for such plants as he would be glad to grow the following season. He will not find a great many such

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plants, but he will find a few, and these he should select and carefully tag for seed. The stalks must not be cut or have the fodder pulled from them at all. Let the stalks dry up and the ears cure out thoroughly before taking them in from the field.

BREEDING PLAT.

Select enough of these ideal plants for the crop next season and reserve a number of the best of these carefully selected ears for the breeding plat.

The breeding plat should be on land similar in all respects to the land on which the general crop is to be planted. In this plat plant some fifty or one hundred rows of fifty to one hundred hills each from the best ears selected in the field from the general crop, and fertilize and cultivate just as you would the rest of the corn crop.

It is a well established fact that seed corn that has been crossed makes a better yield and a better quality of corn than seed that has been inbred. You must, therefore, select from this breeding plat only such ears as have been rigidly crossed.

In order to insure rigid crossing in the seed patch you have only to resort to the simple operation of detasseling every other row or every other hill, leaving tassels in the two outside rows.

Do not pull the fodder from the breeding plat, but let the stalks dry up and the ears remain in the field until they have dried out thoroughly. Now go into the breeding plat and select your seed corn for the next crop. Take only the best ears from the best stalks. It would be well, however, to make a careful examination of the plat before the stalks dry up, in order to note any tendency to disease among the stalks. Those stalks showing susceptibility to any of the common diseases of corn should either be cut out at once or so marked that ears will not be taken from them for seed at gathering time. Be sure that every ear selected for seed the following year is taken from a detasseled stalk. Not a single ear, no matter how beautiful it may be, should be taken from a stalk in which the tassel has been allowed to grow.

Enough corn should be selected from this breeding plat to plant the general crop, but the very best ears in the plat should be kept for the breeding plat the following year. Always plant the very best selection in the breeding plat and save the rest for the general crop. You will thus gradually increase the general strength and vigor of your whole crop by concentrating your efforts on a small area from year to year with a view to increasing the vitality and prolificacy of the strain.

PRESERVATION OF SEED.

Having thus carefully selected your seed corn, the next step is to give it proper care and attention till planting time. The best and most viable seed corn may have its germinating power greatly reduced by improper handling and storing during the winter months.

The first essential in the preservation of seed corn is a dry place. After having been allowed to dry out thoroughly in the fall, the ears should be crefully stored in a dry place where rats cannot get at them and where the corn weevil is not likely to bother. Seed corn should by no means be stored in an open crib or a damp cellar.

On one occasion, "Four bushels of corn were harvested and divided

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into two equal parts. One part was well dried and kept dry during the winter in a seed house and the other kept in an ordinary corn crib. On rich bottom land the well preserved seed produced 18 bushels more per acre than the cribbed seed; while on poor upland, the well preserved seed produced 7 bushels more per acre than the cribbed seed. The cribbed seed germinated as well as the well preserved seed, but the resulting plants were less thrifty and less productive."

It is thus highly important that the seed corn be kept with great care through the winter months.

GERMINATION TEST.

Every farmer wants to know what per cent of his corn is capable of coming up, before he puts it into the ground. Some weeks before planting, therefore, the seed corn should always be put through the germination test. This may be done in different ways. Each ear may be shelled separately and ten grains put in moist soil or on moist blotting paper and kept in a warm place till they sprout. Note carefully how many of these ten grains, taken at random, make a good, vigorous germination, sending out both root and leaf. Another method allows all the seed corn to be shelled and a sample of one hundred grains taken at random and put in the test. In the first case the number of grains germinating multiplied by ten will give the per cent of germination secured. For example: if six grains out of the ten make a good germination this would equal a germination of 60 per cent. In the latter case the actual number of grains in the hundred that germinated would represent the percentage of germination secured. Note carefully the strength and rigor of germination, since some grains have enough vitality to barely germinate, but not enough to make much farther growth. It is much better to make a germination test of each ear, as by this method you can pick out and discard any that have low vitality, whereas this could not be done if all the ears were shelled together.

PLANTING.

Date of Planting.

The best time for planting corn will vary with the locality. In general, it is better to defer planting in favor of thorough preparation of the seed bed than to rush the seed into the ground while it is yet cold and damp from the frosts of winter. A good warm seed bed is very essential to the prompt germination and rapid early growth of the corn plant, and this condition cannot be obtained when the crop is planted too early. Again, early planted corn, unless planted very early, is generally more subject to the depredations of cut-worms and other insect pests, especially when planted on sod land, than when planted later.

Depth of Planting.

Early planted corn should not be planted so deep as that planted later in the season, since early in the spring the ground is cold and germination is more sluggish. As the season advances the depth of planting may be increased.

When the seed bed has been properly prepared, furrows should be run some five to six inches deep, leaving four to five inches of loose

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finely pulverized soil between the bottom of this furrow and the unbroken sub-soil beneath. In the bottom of this furrow the corn should be planted, but covered shallow. Corn is generally planted too near the surface, especially in the piedmont section, where the midsummer drought is most severe. Here the corn should have its root system develop rather deeply in order to come in contact with better and more lasting moisture conditions. When a large amount of green vegetation has been cut up and incorporated with the soil it is highly necessary that the crop should be planted deep below the surface (but covered shallow) in order to escape the drying effects of the first three to four inches of the surface soil during the first two or three weeks of the season. Then, too, the root system gets thorough hold of the deeper soil and gradually, as the season advances, rises to the upper soil and finally occupies the whole soil stratum, thus utilizing all the available plant food present. Of course, corn must not be planted too deep, but a small amount of careful observation and a little experimentation on a given soil will enable the farmer to judge very closely of the proper depth of planting for best results. The more deeply planted corn does not grow off so rapidly, as a rule, but withstands the midsummer drought better and yields more corn in the fall.

Thickness of Planting.

The thickness of planting will vary with the variety and the fertility of the soil. It will be borne in mind that the high individual acre yields that have been made in the South during the past two or three years were not made so much by the increased prolificacy of the individual stalks as by the increased number of stalks per acre.

On account of the irregularity of our fields the checking of corn by means of the check-row planter is never likely to become general. The crop is now generally planted in the drill and, so far as we know, there is no economic necessity for changing this time-honored method.

The drilling of the crop gives the opportunity for proper spacing in the row; the thickness of planting can be regulated to a nicety. Experiments seem to indicate that one stalk in a hill with hills close together give better results than the same number of stalks per acre with, say, two stalks in a hill. That is, it is better to have the stalks twelve inches apart and one in a hill than to have the hills three feet apart and three stalks in a hill.

Thinning to a Stand.

The old corn planting proverb of "one for the jaybird, one for the crow, two for the cut worm, and one to grow" was based on sound philosophy. Enough corn should always be planted to the hill to insure the perfect stand, knowing full well that a number of accidents, such as are suggested in the above adage, are almost sure to occur.

When the plants get up some size and are ready for thinning the field should be thinned to a stand, not all at once, but gradually, say, in two or, possibly three different thinnings, the last one to be made when all probable accidents from depredations of birds, worms, and insects have passed. Having secured the perfect stand, the yield of the crop is then largely under the control of the farmer and will be in direct proportion to the fertility of his soil and the cultivation given the crop.

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The next most important factor in the production of high yields is the variety or strain of corn used in planting the crop.

VARIETIES AND VARIETY TESTS.

We can never hope to get any one best variety of corn for all our different soil types and climatic conditions, but must expect each of the three or four geographic divisions of the State to develop and require varieties and strains of corn suited to their own peculiar conditions of soil and climate.

There are hundreds of different commercial varieties and strains of corn in the United States today. A number of these commercial varieties have distinguishing characteristics, while many of them have not, but are the same variety listed under different trade names for commercial purposes only. This is, of course, unfortunate, as it serves only to confuse the farmer and causes him, many times, to buy seed corn that he otherwise would not have bought had he known just what the would-be new variety represented. There are, however, a number of good and distinct varieties of corn in North Carolina grown by men of the highest integrity and put on the market under such trade names as will not confuse the buyer. Among these are Biggs' Seven-ear, Goodman's Prolific, Cocke's Prolific, Weekley's Improved, Hickory King, Farmer's Favorite, and a number of others.

In the case of live stock, each breed or strain is developed to meet some special need or demand; so, also, in plants, in general, a variety is the result of a definite set of environmental conditions that have combined to produce the variations that go to make the new strain. The variety, then, is the result of either changed natural conditions or of effect along lines carefully laid with a view to adapt and adjust strains of plants to the new environmental conditions. The variety thus developed is, in the nature of the case, adapted to the surroundings where it has been making its best yields.

In the case of corn the mere existence of corn varieties carries with it the suggestion that they are not all equally well suited to all climatic and soil conditions, and that each one has. doubtless, proven to be the best variety tested in its native locality. We are to assume, then, that these are all good corns when grown under favorable soil and climatic conditions. Again, since varieties of plants are generally developed in a given locality under given soil and climatic conditions, it follows that they will make as good, if not better, yields when propagated under soil and climatic conditions similar to those under which they have been developed. Now, if there be a probability that varieties of corn will make better yields in their native environments than elsewhere, it follows that the adaptability of the many different varieties put on the market should be tested. If any of them are well suited to the climate and soils of our State it is worth our while to know it. Should they not be adapted to our conditions, such knowledge is a necessary protection against loss. The only way to gain this knowledge is to subject these corns to a rigid test on our soils. The recommendations of the seedmen are frequently unreliable, since they never know whether the environment in which the variety has been developed is similar to the one in which it will be forced to grow.

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With a view then to protect the farmer against the frauds of unscrupulous seedmen and originators on the one hand, and to ascertain the varieties best suited to the soils of the State on the other, the North Carolina Agricultural Experiment Station began, several years ago, to collect corn varieties from different parts of the country, and to subject them to a rigid test on the recognized corn soils of the State. Since then over sixty different varieties have been collected and tested, some for longer, others for shorter periods.

The reader will bear in mind that in any given year all of the varieties tested were subjected to identical soil and climatic conditions at different points in the State and received identical treatment as to cultivation, fertilization, and previous preparation of land.

In 1912 we put out varieties of corn at a number of different points in the State, covering as many different soil types. Table No. 1 shows results of the test of twenty-nine different varieties on the black peaty soils of the Dismal Swamp lands at Moyock. The five highest yielding varieties here were White Majestic, Cocke's Polific, Marlboro Prolific, Batts' Four-ear, and Weekley's Improved, while the five lowest ranking corns, in point of yield, were E-1-Corn, Cogswell, Shenandoah White Dent, and Boone County Special.

Table No. 2 shows the results obtained from the test of twenty-nine different varieties on the Norfolk fine sandy loam soils of Edgecombe County, on the Edgecombe Test Farm. Here the five highest yielding varieties were Biggs' Seven-ear, Parker's Prolific, Summerour, Marlboro Prolific, and Poole, while the lowest yielders were Sanders' Improved, Cross No. 176, Cogswell, Southern Beauty, and Selection 170, in the order named.

Table No. 3 shows results of tests of twenty-seven different varieties and strains on the Cecil loam soil of Iredell County at Statesville. Here the five highest yielding varieties were Biggs' Seven-ear, Gerrick's Prolific, First Generation Cross No. 182, Parker's Prolific, and Boone County Special; while Selection No. 170, Brooks' Pride, Cogswell, Sanders' Improved, and Selection No. 164 made the lowest yields in the order named.

Table No. 4 shows results of the test of thirty-five different varieties and strains on the Porters loam soil of Buncombe County on the Test Farm at Swannanoa. Here the five highest yielding varieties were Indian Twin, Batts' Four-Ear, First Generation Cross No. 182, Biggs' Seven-Ear, and Cogswell; while Weekley's Improved, Columbia Beauty, Selection No. 164, Snow Flake, and Brooks' Pride made the lowest yields in the order named.

Table No. 5 includes the compiled results of variety tests made at the Edgecombe Test Farm from 1909 to 1912 inclusive. During this time, from one cause or another, but seven varieties were carried through the tests of the entire period; the two highest yielding varieties were Biggs' Seven-ear and Hickory King; the two lowest yielders were Boone County White, and Parker's Prolific.

Table No. 6 contains results of the variety tests of corn at the Iredell Test Farm covering the same period. Here the two highest yielding strains, during the four year period, were Southern Beauty, and Parker's Prolific, with Goodman's Prolific and Hickory King making the lowest yielding records.

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TABLE No. I.—VARIETY TEST OF CORN AT MOYOCK IN 1912.

Varieties	Stalks Per Plat			Yield Per Plat		Yield Per Acre				Pounds of Ears to Shell One Bushel	Total Weight		Shelling Capacity		Weight of Measured Bushel of Shelled Corn	Rank According to Yield
	For Perfect Stand	By Actual Count	Barren Stalks	Pounds of Stover	Pounds of Ears	Pounds of Stover	Pounds of Ears	Bushels of Shelled Corn	Bushels of Shelled Corn With Perfect Stand		Per Cent Stover	Per Cent. Ears	Per Cent. Grain	Per Cent. Cob		
White Majestic	240	217	23	92	119	2,024	2,618	37.4	41.3	73	43.6	56.4	87.6	12.4	63	1
Cocke's Prolific	240	198	20	84	114	1,848	2,508	35.8	43.3	75	42.	57.6	81.3	18.7	61	2
Marlboro Prolific (S. C. Grown)	240	209	26	91	108	2,002	2,376	33.9	38.9	80	45.7	54.3	81.2	18.8	65	3
Batts' Four-ear	240	240	54	83.5	103.5	1,837	2,277	32.5	32.5	79	44.6	55.4	82.2	17.8	65	4
Weekley's Improved	240	185	19	69	98	1,518	2,156	30.8	39.9	75	41.3	58.7	82.6	17.4	62	5
Snow Flake	240	206	45	76	97	1,672	2,134	30.4	35.4	68	43.9	56.1	83.8	16.2	57	6
Blount's Prolific	240	168	3	67	90.5	1,474	1,991	28.4	40.5	76	42.5	57.5	80.2	19.8	61	7
First Gen. Cross No. 182	240	179	12	40	80	880	1,760	25.1	33.6	75	33.3	66.7	82.6	17.4	62	8
Indian Twin	240	187	28	56	79	1,232	1,738	24.8	36.1	76	41.4	58.6	81.5	18.5	62	9
Biggs' Seven-ear	240	190	18	51.5	77	1,133	1,694	24.2	30.5	78	40.0	60.0	82.0	18.0	64	10
Eureka	240	183	37	66.5	73	1,463	1,606	22.9	30.0	77	47.6	52.4	76.6	23.4	59	11
Goodman's Prolific	240	214	91	57.5	73	1,265	1,606	22.9	25.6	66	44.0	56.0	86.3	13.7	57	11
Poole	240	176	17	38.5	69	847	1,518	21.6	29.4	74	35.8	64.2	83.7	16.3	62	12
Sanders' Improved	240	153	17	53	68.5	1,166	1,507	21.5	33.7	69	43.6	56.4	86.9	13.1	60	13
Marlboro Prolific (Tenn. Grown)	240	207	40	67	68	1,474	1,496	21.3	24.6	77	49.6	50.4	81.8	18.2	63	14
Columbia Beauty	240	156	10	32.5	62.5	715	1,375	19.6	30.1	70	34.2	65.8	85.7	14.3	60	15
Southern Beauty	240	157	21	35.5	61	781	1,342	19.1	29.1	67	36.7	63.3	86.5	13.5	58	16
Hickory King	240	134	9	43.5	59.5	957	1,309	18.7	33.4	75	42.2	57.8	84.0	16.0	63	17
Parker's Prolific	240	212	60	41	59	902	1,298	18.5	20.9	76	41.0	59.0	81.5	18.5	62	18
Summerour	240	217	110	61	57.5	1,342	1,265	18.0	19.9	72	51.4	48.6	83.3	16.7	60	19
Boone County Special	240	147	20	32	55	704	1,210	17.2	28.0	74	36.7	63.3	78.3	21.7	58	20
Shenandoah White Dent	240	120	13	33	53.5	726	1,177	16.8	33.6	72	38.1	61.9	83.3	16.7	60	21
Cogswell	240	179	45	46.5	50.5	1,023	1,111	15.8	21.7	81	47.9	52.1	77.7	22.3	63	22
E-1-Corn	240	182	10	56	48	1,332	1,056	15.0	19.7	71	53.8	46.2	81.6	18.4	58	23

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TABLE No. II.—VARIETY TEST OF CORN AT THE EDGECOMBE TEST FARM IN 1912.

Varieties	Stalks Per Plat			Yield Per Plat		Yield Per Acre				Total Weights		Shelling Capacity			Rank According to Yield
	For Perfect Stand	By Actual Count	Barren Stalks	Pounds of Stover	Pounds of Ears	Pounds of Stover	Pounds of Ears	Bushels of Shelled Corn	Bushels of Shelled Corn With Perfect Stand	Pounds of Ears to Shell One Bushel	Per Cent. Stover	Per Cent. Ears	Per Cent. Grain	Per Cent. Cob	Weight of Measured Bushel of Shelled Corn	
Biggs' Seven-ear	272	174	12	110	96	2,200	1,930	27.1	42.3	77	53.6	46.4	80.5	19.5	62	1
Parker's Prolific	272	133	9	72.5	87.5	1,450	1,750	25	51.1	75	45.3	54.7	80.0	20.0	60	2
Summerour	272	170	33	98.5	86.5	1,970	1,730	24.7	39.5	81	53.2	46.8	80.2	19.8	65	3
Marlboro Prolific (Tennessee Grown)	272	159	21	64	86	1,280	1,720	24.5	41.9	78.75	42.6	57.4	81.2	18.8	64	4
Poole	272	143	5	72	78	1,440	1,560	22.2	42.2	73	48.0	52.0	82.1	17.9	60	5
Goodman's Prolific	272	173	37	143	77	2,860	1,540	22	34.5	73	65.0	35.0	84.9	15.1	62	6
Gerrick's Prolific	272	153	33	78	77	1,560	1,540	22	39.1	74.75	50.3	49.7	80.5	19.5	60	6
Indian Twin	272	133	16	98	72	1,960	1,440	20.5	41.9	77	51.6	42.4	80.5	19.5	62	7
Eureka	272	148	37	148.5	71.5	2,970	1,430	20.4	37.2	77.75	67.5	32.5	79.7	20.3	62	8
Batts' Four-ear	272	136	17	49.5	70.5	990	1,410	20.1	40.2	77.5	41.2	58.8	80.0	20.0	62	9
One-ear Corn	272	131	13	91	69	1,820	1,380	19.7	40.9	75	56.8	43.2	81.3	18.7	61	10
Weekley's Improved	272	133	23	62	68	1,240	1,360	19.4	39.6	76	47.6	52.4	78.9	21.1	60	11
Hickory King	272	141	20	48	67	960	1,340	19.1	36.8	67.5	41.7	58.3	85.9	14.1	58	12
Cocke's Prolific	272	150	31	114	66	2,280	1,320	18.8	34.0	74	63.3	36.7	81.0	19	60	13
Selection No. 177	272	135	11	40	65	800	1,300	18.5	37.2	74	38.0	62.0	83.7	16.3	62	14
Selection No. 164	272	167	24	95	65	1,900	1,300	18.5	30.1	76	59.3	40.7	81.5	18.5	62	14
White Majestic	272	131	7	105	65	2,100	1,300	18.5	37.4	75.25	61.7	38.3	82.3	17.7	62	14
First Gen. Cross No. 182	272	127	10	51	64	1,020	1,280	18.2	39.7	72.25	44.3	55.7	80.2	19.8	58	15
Marlboro Prolific (S. C. Grown)	272	139	37	97	63	1,940	1,260	18.0	35.2	75	66.2	33.8	82.6	17.4	62	16
Brooks' Pride	272	100	15	71	59	1,420	1,180	16.8	45.6	70	54.6	45.4	82.8	17.2	58	17
Snow Flake	272	121	22	56	59	1,120	1,180	16.8	37.6	74	48.6	51.4	81.0	19.0	60	17
Boone County Special	272	130	19	73	57	1,460	1,140	16.2	33.8	74.5	56.1	43.9	80.5	19.5	60	18
Farley's Yellow Dent	272	126	24	58	57	1,160	1,140	16.2	34.9	70	50.4	49.6	80.0	20.0	56	18
Columbia Beauty	272	135	17	101	54	2,020	1,080	15.4	31.0	72	65.1	34.9	80.5	19.5	58	19
Selection No. 170	272	100	38	72	53	1,440	1,060	15.1	41.0	73	57.6	42.4	79.4	20.6	58	20
Southern Beauty	272	110	15	87.5	52.5	1,750	1,050	15	37.0	66.25	62.5	37.5	86.0	14.0	57	21
Cogswell	272	121	40	53.5	46.5	1,070	930	13.2	29.6	77	53.9	46.1	77.9	22.1	60	22
Cross No. 176	272	145	13	68	42	1,360	840	12	22.5	61	61.8	38.2	81.9	18.1	50	23
Sanders' Improved	272	140	35	113	37	2,260	740	10.5	20.4	69	75.3	24.7	84.0	16.0	58	24

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TABLE No. III.—VARIETY TEST OF CORN AT THE IREDELL TEST FARM IN 1912.

Varieties	Stalks Per Plat			Yield Per Plat		Yield Per Acre				Pounds of Ears to Shell One Bushel	Total Weights		Shelling Capacity		Weight of Measured Bushel of Shelled Corn	Rank According to Yield
	For Perfect Stand	By Actual Count	Barren Stalks	Pounds of Stover	Pounds of Ears	Pounds of Stover	Pounds of Ears	Bushels of Shelled Corn	Bushels of Shelled Corn With Perfect Stand		Per Cent. Stover	Per Cent. Ears	Per Cent. Grain	Per Cent. Cob		
Biggs' Seven-ear	230	241	20	96.5	132.5	2,297	3,154	45.0	42.9	77.5	42.2	57.8	80.0	20.0	62	1
Gerrick's Prolific	230	211	26	128.5	99.75	3,059	2,375	43.7	47.6	75	56.3	43.7	80.0	20.0	60	2
First Gen. Cross No. 182	230	219	10	70.5	124	1,678	2,952	42.1	44.2	72	36.3	63.7	80.5	19.5	58	3
Parker's Prolific	230	225	19	87	122	2,071	2,904	41.4	42.3	76	41.7	58.3	79.6	20.4	60.5	4
Boone County Special	230	233	35	90	118.5	2,142	2,821	40.3	39.7	72	43.2	56.8	80.5	19.5	58	5
Poole	230	215	22	82	114	1,952	2,714	38.7	41.4	73	41.9	58.1	83.5	16.5	61	6
Indian Twin	230	191	17	81.5	113.5	1,940	2,702	38.6	46.4	78.5	41.8	58.2	79.6	20.4	62.5	7
Selection No. 177	230	205	24	81	113	1,928	2,690	38.4	43.0	72.5	41.8	58.2	82.7	17.3	60	8
Southern Beauty	230	223	7	85	112.5	2,023	2,678	38.2	39.3	68	43.1	56.9	83.8	16.2	57	9
Goodman's Prolific	230	229	38	112	112	2,666	2,666	38.0	38.1	71	50.0	50.0	85.9	14.1	61	10
Hickory King	230	228	25	92	106.5	2,191	2,535	36.2	36.5	70.5	46.5	53.5	85.1	14.9	60	11
Columbia Beauty	230	224	38	100	105	2,380	2,500	35.7	36.6	70	48.8	51.2	82.8	17.2	58	12
Batts' Four-ear	230	216	28	92.5	103.5	2,202	2,464	35.2	37.4	79.5	47.2	52.8	79.8	20.2	63.5	13
Marlboro Prolific (Tennessee Grown)	230	214	18	90.5	103	2,154	2,452	35.0	37.6	80	46.8	53.2	80.0	20.0	64	14
Eureka	230	216	43	127	103	3,023	2,452	35.0	37.2	77	55.3	44.7	79.2	20.8	61	14
Weekley's Improved	230	217	28	82.5	101	1,964	2,404	34.3	36.3	77.5	45.0	55.0	80.6	19.4	63	15
Marlboro's Prolific (S. C. Grown)	230	217	20	92	100	2,191	2,380	34.0	36.0	76.5	48.0	52.0	81.6	18.4	62.5	16
Cocke's Prolific	230	203	7	80	100	1,904	2,380	34.0	38.5	79.5	44.5	55.5	77.9	22.1	62	16
Farley' Yellow Dent	230	197	25	63.5	96.75	1,511	2,303	32.9	38.4	74	39.7	60.3	79.7	20.3	59	17
One Ear Corn	230	224	25	115	97	2,738	2,309	32.9	33.7	71	54.3	45.7	81.6	18.4	58	17
Cross No. 176	230	230	23	109	96.5	2,595	2,297	32.8	32.8	74	53.1	46.9	81.0	19.0	60	18
Summerour	230	231	24	115	93	2,738	2,214	31.6	31.4	78.5	55.3	44.7	80.2	19.8	63	19
Selection No. 164	230	189	27	84	82	2,000	1,952	28.5	34.6	75	50.7	49.3	81.3	18.7	61	20
Sanders' Improved	230	188	18	87	81	2,011	1,928	27.5	33.6	66.5	51.8	48.2	84.9	15.1	56.5	21
Cogswell	230	188	30	69	80.25	1,642	1,910	27.2	33.2	78	46.3	53.7	76.9	23.1	60	22
Brooks' Pride	230	191	21	81	79.5	1,928	1,892	27.0	32.5	69.5	50.5	49.5	83.4	16.6	58	23
Selection No. 170	230	201	22	106.5	72	2,535	1,714	24.4	27.9	74.5	59.7	40.3	76.3	23.7	56.5	24

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TABLE No. IV.—VARIETY TEST OF CORN AT THE BUNCOMBE TEST FARM IN 1912.

Varieties	Stalks Per Plat			Yield Per Plat		Yield Per Acre				Total Weights		Shelling Capacity			Rank According to Yield
	For Perfect Stand	By Actual Count	Barren Stalks	Pounds of Stover	Pounds of Ears	Pounds of Stover	Pounds of Ears	Bushels of Shelled Corn	Bushels of Shelled Corn With Perfect Stand	Per Cent. Stover	Per Cent. Ears	Per Cent. Grain	Per Cent. Cob	Weight of Measured Bushel of Shelled Corn	
Indian Twin	120	120	2	60	78	2,160	2,808	40.1	40.1	43.4	56.6				1
Batts' Four-ear	120	123	1	48	77.5	1,728	2,790	38.4	37.4	39.1	60.9				1
First Gen. Cross No. 182	120	114	2	71	73	2,556	2,628	37.5	39.4	49.3	50.7				3
Biggs' Seven-ear	120	120	3	73	72	2,628	2,592	37.0	37.0	50.3	49.7				4
Cogswell	120	118	3	67	71	2,412	2,556	36.5	37.08	48.5	51.5				5
Weekley's Improved	120	122	5	78	71.5	2,808	2,574	35.9	35.3	52.5	47.5				6
Cocke's Prolific	120	119	4	54.5	68.5	1,962	2,466	35.2	35.4	46.5	53.5				7
Marlboro Prolific (Tennessee Grown)	120	118	2	73.5	67.5	2,646	2,430	34.7	35.2	52.1	47.9				8
Selection No. 170	120	112	15	104	67	3,744	2,412	34.4	36.8	60.6	39.4				9
Selection No. 177	120	124	5	67	65.5	2,412	2,358	33.6	32.5	50.5	49.5				10
Gerrick's Prolific	120	115	11	77.5	65.5	2,790	2,358	33.5	34.9	53.2	46.8				11
Blount's Prolific	120	116	19	73.5	65	2,646	2,340	33.4	34.5	53.0	47.0				12
Boone County Special	120	115	4	76	65	2,736	2,340	33.4	34.8	53.9	46.1				12
Poole	120	124	4	58	64.5	2,088	2,322	33.1	32.0	47.3	52.7				13
Hickory King	120	120	2	60	64	2,160	2,304	32.8	32.8	48.3	51.7				14
Marlboro Prolific (South Carolina Grown)	120	119	3	86	64	3,096	2,304	32.8	33.0	57.3	42.7				14
Parker's Prolific	120	118	0	80.5	62.5	2,898	2,250	32.1	32.6	56.2	43.8				15
White Majestic	120	120	4	49	61	1,764	2,196	31.3	31.3	44.5	55.5				16
Shenandoah White Dent	120	111	11	56	61	2,016	2,196	31.3	33.8	47.8	52.2				16
Iowa Silver Mine	120	118	10	52.5	61	1,890	2,196	31.3	31.8	46.2	53.8				16
Farley's Yellow Dent	120	117	5	48	60.5	1,728	2,178	31.1	31.8	44.2	55.8				17
Cross No. 176	120	110	8	82.5	60	2,970	2,160	30.8	36.3	57.8	42.2				18
One-ear Corn	120	117	7	85.5	59.5	3,078	2,142	30.6	31.3	58.9	41.1				19
Bigg's Seven-ear (native)	120	120	9	54	59.5	1,944	2,142	30.6	30.6	47.5	52.5				19
Sanders' Improved	120	118	14	72.5	59	2,610	2,124	30.3	30.8	55.1	44.9				20

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TABLE No. IV.—VARIETY TEST OF CORN AT THE BUNCOMBE TEST FARM IN 1912—*Continued.*

Varieties	Stalks Per Plat			Yield Per Plat		Yield Per Acre				Total Weights		Shelling Capacity			
	For Perfect Stand	By Actual Count	Barren Stalks	Pounds of Stover	Pounds of Ears	Pounds of Stover	Pounds of Ears	Bushels of Shelled Corn	Bushels of Shelled Corn with Perfect Stand	Per Cent. Stover	Per Cent. Ears	Per Cent. Grain	Per Cent. Cobs	Weight of Measured Bushels of Shelled Corn	Rank According to Yield.
Stevens' Favorite	120	118	10	53.6	58.5	1,926	2,106	30.0	30.5	47.7	52.3	.....	.....	.....	21
Summerour	120	120	8	100	58	3,600	2,088	29.8	29.8	63.2	36.8	.....	.....	.....	22
Eureka	120	117	7	72	58	2,592	2,088	29.8	30.5	55.3	44.7	.....	.....	.....	22
Goodman's Prolific	120	118	10	70.5	56	2,538	2,016	28.8	29.2	55.7	44.3	.....	.....	.....	23
Southern Beauty	120	113	9	67.5	55.5	2,430	1,998	28.5	30.2	54.8	45.2	.....	.....	.....	24
Brooks' Pride	120	112	9	83.5	55.5	3,006	1,998	28.5	30.5	60.0	40.0	.....	.....	.....	24
Snow Flake	120	120	4	57	55.5	2,052	1,998	28.5	28.5	50.6	49.4	.....	.....	.....	24
Selection No. 164	120	120	5	103.5	54.5	3,726	1,962	28.0	28.0	65.5	34.5	.....	.....	.....	25
Columbia Beauty	120	120	9	66	53.5	2,376	1,926	27.5	27.5	55.2	44.8	.....	.....	.....	26
Weekley's Improved (native)	120	122	5	32.5	45.5	1,170	1,638	23.4	23.0	41.6	58.4	.....	.....	.....	27

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TABLE No. V.—COMPILED RESULTS OF VARIETY TEST OF CORN—EDGECOMBE TEST FARM.

Varieties	1909		1910		1911		1912		Average for Four Years	
	Yield of Shelled Corn in Bushels Per Acre	Rank According to Yield of Shelled Corn in Test of this Year	Yield of Shelled Corn in Bushels Per Acre	Rank According to Yield of Shelled Corn in Test of this Year	Yield of Shelled Corn in Bushels Per Acre	Rank According to Yield of Shelled Corn in Test of this Year	Yield of Shelled Corn in Bushels Per Acre	Rank According to Yield of Shelled Corn in Test of this Year	Average Yield of Shelled Corn Per Acre	Rank According to Average Yield
Biggs' Seven-ear	41.5	1	31.9	2	26.5	3	21.1	1	30.2	1
Hickory King	30	13	35.5	1	24.3	8	19.1	12	27.2	2
Weekley's Improved	40.7	2	23.3	15	20.6	17	19.4	11	26.0	3
Goodman's Prolific	31.5	10	23.6	13	26.3	4	22.0	6	25.8	4
Southern Beauty	27.2	21	31.3	3	27.6	2	15.0	21	25.2	5
Parker's Prolific	15.6	31	26.0	8	23.4	10	25.0	2	22.5	6
Boone County	13.7	32	25.1	10	21.4	16	16.2	18	19.1	7

TABLE No. VI.—COMPILED RESULTS OF VARIETY TEST OF CORN—IREDELL TEST FARM.

Southern Beauty	30.4	5	39.4	1	38.3	2	38.2	9	36.5	1
Parker's Prolific	34.2	1	35.2	6	34.0	9	41.4	4	36.2	2
Boone County	31.0	3	32.8	8	35.1	7	40.3	5	34.6	3
Weekley's Improved	26.5	14	38.4	2	38.9	1	34.3	15	34.5	4
Biggs' Seven-ear	26.0	17	29.5	16	32.4	16	45.0	1	33 2	5
Hickory King	21.5	30	32.1	9	34.6	8	36.2	11	31.1	6
Goodman's Prolific	24.2	22	31.7	11	31.8	18	38.0	10	30.7	7

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THE BEST VARIETY TO USE.

In case care has been taken in the selection and adaptation of the seed, we unhesitatingly say the best variety for you to use is the one you have developed on your own farm. By adaptation we mean the growing of the same variety on the same kind of land for a sufficient length of time to allow it to become adjusted to its soil and climatic surroundings.

The varieties of corn that have given good results in the piedmont section for the past several years are Weekley's Improved, Southern Beauty, and Cocke's Prolific.

Those that have done well in the coastal plains section are Cocke's Prolific, Biggs' Seven-ear, Southern Beauty, and Hickory King.

Most of the varieties tested are one and two-eared corns, the leading prolifics being Biggs' Seven-Ear, Marlboro Prolific, Indian Twin, Blount's Prolific, and Weekley's Improved. The prolificacy of any corn, however, depends on the conditions of fertility under which it is grown, so that what may be a prolific variety one season or in one locality, may be a two or even a one-eared variety another season or in another locality.

SOURCES OF SEED CORN TESTED IN 1912.

1	Eureka	T. W. Wood & Sons	Richmond, Va.
2.	Boone County Special	T. W. Wood & Sons	Richmond, Va.
3.	Columbia Beauty	T. W. Wood & Sons	Richmond, Va.
4.	Goodman's Prolific	J. K. Goodman	Mt. Ulla, N. C.
5.	Southern Beauty	L. A. Stroupe	Tobaccoville, N. C.
6.	Poole	J. C. Poole	Marion, N. C.
7.	E-1-Corn	D. B. Coker	Hartsville, N. C.
8.	Summerour	D. A. Summerour	Marietta, Ga.
9.	Parker's Prolific	T. B. Parker	Raleigh, N. C.
10.	Marlboro Prolific	R. T. Malone	Capleville, Tenn.
11.	Biggs' Seven-Ear	Noah Biggs	Scotland Neck, N. C.
12.	Hickory King	A. C. Lee	Hickory, N. C.
13.	1. Gen. Cross No. 182	Bureau of Plant Industry	Washington, D. C.
14.	Indian Twin	H. T. Macon	Warrenton, N. C.
15.	Batts' Four-Ear	J. F. Batts	Garner, N. C.
16.	Cogswell	B. C. Hawkins	Highlands, N. C.
17.	Marlboro Prolific	Excelsior Seed Farm	Cheraw, S. C.
18.	Sanders' Improved(?)	Experiment Farm	West Raleigh, N. C.
19.	Cocke's Prolific	Edgecombe Farm	Rocky Mount, N. C.
20.	Weekley's Improved	Iredell Farm	Statesville, N. C.
21.	Brook's Pride	Bureau of Plant Industry	Washington, D. C.
22.	Selection No. 170	Bureau of Plant Industry	Washington, D. C.
23.	Cross No. 176	Bureau of Plant Industry	Washington, D. C.
24.	Selection No. 177	Bureau of Plant Industry	Washington, D. C.
25.	Fraley's Yellow Dent	Bureau of Plant Industry	Washington, D. C.
26.	Gerrick Prolific	Bureau of Plant Industry	Washington, D. C.
27.	Selection No. 164	Bureau of Plant Industry	Washington, D. C.
28.	Snow Flake	T. W. Wood & Sons	Richmond, Va.
29.	White Majestic	T. W. Wood & Sons	Richmond, Va.
30.	Blount's Prolific	T. W. Wood & Sons	Richmond, Va.
31.	Shenandoah White Debt.	T. W. Wood & Sons	Richmond, Va.
32.	Steven's Favorite	F. M. Stevens	Azalea, N. C.
33.	Iowa Silver Mine (native)	Buncombe Test Farm	Swannanoa, N. C.
34.	Weekley's Imp. (native)	Buncombe Test Farm	Swannanoa, N. C.
35.	Biggs' Seven-Ear (native)	Buncombe Test Farm	Swannanoa, N. C.

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THE BULLETIN

OF THE

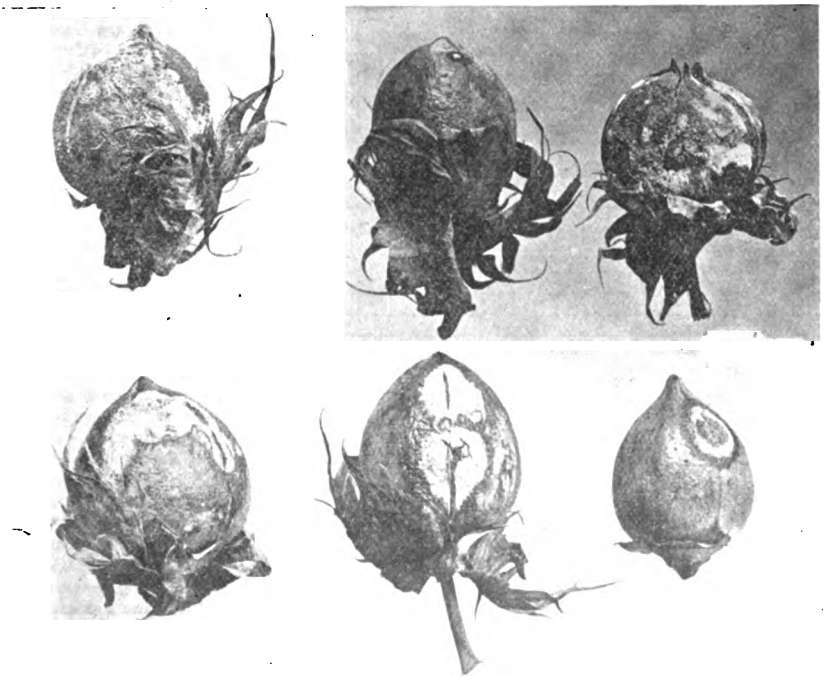
NORTH CAROLINA

DEPARTMENT OF AGRICULTURE

RALEIGH

Volume 34--No. 4. APRIL, 1913. Whole No. 182

SOME IMPORTANT DISEASES OF FIELD CROPS IN NORTH CAROLINA



Anthracnose of Cotton. Bolls showing various stages of the rot.

SENT FREE TO CITIZENS ON APPLICATION.

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J. F. HATCH	Clerk.
F. S. PUCKETT	Assistant to Director Test Farms.
H. H. BRIMLEY	Curator of Museum.
T. W. ADICKES	Assistant Curator.
FRANKLIN SHERMAN, JR.	Entomologist.
C. L. METCALF	Assistant Entomologist.
S. C. CLAPP	Assistant Entomologist in Field Work.
W. G. CHRISMAN	Veterinarian.
B. B. FLOWE	Assistant Veterinarian.
W. H. EATON	Dairyman.
A. M. FLANERY	Assistant Dairyman.
W. N. HUTT	Horticulturist.
S. B. SHAW	Assistant Horticulturist.
R. G. HILL	Assistant Horticulturist.
T. B. PARKER	Director of Farmer's Institutes.
J. M. GRAY	Assistant Director of Farmers' Institutes.
W. M. ALLEN	Pure Food Chemist.
E. W. THORNTON	Assistant Pure Food Chemist.
C. E. BELL	Assistant Pure Food Chemist.
MISS O. I. TILLMAN	Botanist.
Miss S. D. ALLEN	Assistant to Botanist.
J. L. BURGESS	Agronomist.
G. M. GARREN	Assistant Agronomist.
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†E. H. MATHEWSON	Cooperative Assistant in Tobacco Investigations.
C. R. HUDSON	Farm Demonstration Work.
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JOHN H. JEFFERIES, Assistant Director Pender Test Farm, Willard, N. C.
R. W. COLLETT, Assistant Director Transylvania and Buncombe Test Farms, Swannanoa, N. C.

*Assigned by the Bureau of Soils, United States Department of Agriculture.
†Assigned by the Bureau of Plant Industry, United States Department of Agriculture.

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LETTER OF TRANSMITTAL

Hon. W. A. Graham,
Commissioner of Agriculture.

Sir:—I am transmitting herewith manuscript on "Some Important Diseases of Field Crops in North Carolina," by H. R. Fulton and J. R. Winston, which I recommend for publication as the April Bulletin.

Very respectfully,
B. W. Kilgore,
Director.

Approved for printing:
W. A. Graham,
Commissioner.

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SOME IMPORTANT DISEASES OF FIELD CROPS IN NORTH CAROLINA

By H. R. Fulton, Plant Pathologist, and J. R. Winston, Assistant in Plant Pathology, North Carolina Agricultural Experiment Station.

The object of this Bulletin is to give crop growers in a concise form the main facts about certain field crop diseases that are of importance in North Carolina. Some of these have not yet become thoroughly established within our territory, nevertheless their destructiveness and the difficulty of coping with them make a warning appropriate. It is of first importance to prevent their introduction into new territory and to restrict their spread in localities where they have appeared. It has been impossible to discuss all the diseases of field crops. It is hoped that the descriptions will insure the correct identification of those included here. If there is any question on this score, or if other diseases attract attention, the Division of Plant Pathology, Agricultural Experiment Station, will be glad to render any aid possible.

In preparing this account the experience of other workers has been freely drawn upon, and it is regretted that the many sources of valuable information can not be acknowledged specifically. One is at once struck with the fact that the most serious group of diseases in this State is that of the soil diseases—those that persist in the soil for years, entering the plants mainly through their roots. Very valuable work upon certain diseases of this class has been done by Dr. Erwin F. Smith, Mr. W. A. Orton, and Dr. Ernst A. Bessey, of the United States Bureau of Plant Industry. Mention should also be made of the very successful work on cotton anthracnose by Professor H. W. Barre, of the South Carolina Experiment Station.

The distribution in this State of the diseases here discussed is by no means fully known. The records at hand indicate merely their general range.

CLOVER AND ALFALFA STEM ROT.

Distribution in North Carolina.—The disease has been reported from Alamance, Granville, Guilford, Halifax, Lincoln, Mecklenburg, Rowan, and Wake counties.

Plants Affected.—Crimson clover, red clover, alsike clover, alfalfa.

This disease is sometimes called sclerotiniose and wilt.

Symptoms.—Individual plants die here and there over the field. If the stems are succulent they collapse in a dry mass on the ground; if more woody, they stand erect and the dying plants are more conspicuous. The stems are decayed, usually near, but frequently just below, the surface of the ground. On the dead parts there will be found the white felt-like growth of the fungus and intermingled some irregularly shaped, firm, black masses that vary from the size of a clover seed to

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that of a cowpea. These bodies are called *sclerotia,* and are the most distinctive indication of this disease. A less serious root rot of clovers, caused by the fungus *Rhizoctonia,* may show similar general symptoms, but the sclerotia are lacking.

Cause.—The cause of this disease is a fungus, *Sclerotinia,* that may live over in the soil on decaying vegetable material from one season to the next. The sclerotia are particularly adapted for withstanding extremes of temperature and moisture and on the return of favorable conditions may start the disease. The disease has only recently begun to be serious in the United States. It is closely similar to the wilt or drop of lettuce.

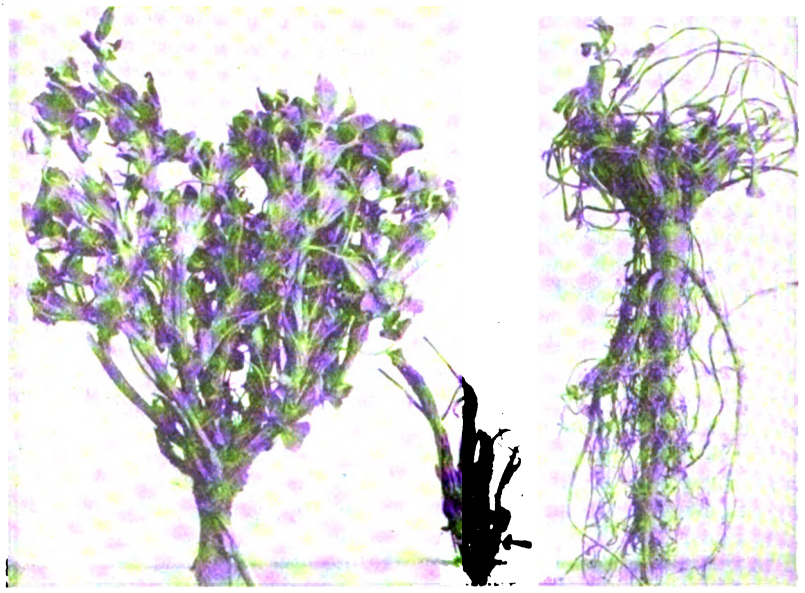

FIG. 1. Stem Rot of Clover. Slightly affected plant on the left, badly affected one on the right. Note sclerotia on stem in the middle; one is just above the head of the arrow and another smaller, round one is in line with the arrow at the center.

Dissemination.—The smallest of the sclerotia are about the size of clover seeds and are not removed in the usual processes of cleaning. A few of these may start the disease in a field. It will spread gradually from these centers by growth of the fungous threads to neighboring plants, causing a slow but progressive enlargement of affected areas. Preparation of the soil for later crops will distribute the infective material up and down the rows, and there is danger of a large increase the second and third years, if susceptible crops are grown on the land. Any transfer of infected soil would serve to spread this disease, either through washing by water or through the agency of farm implements or stock. In using soil for inoculation of leguminous crops with tuber-

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cle organisms extreme care must be taken to avoid any field having this or any other soil disease. While no positive statement can be made it is very likely that the feeding of affected plants would lead to the infection of stable manure, by means of which the disease would be carried readily to new places.

Infection.—Infection is favored by wet seasons, by high moisture content of the soil, by mild winters, and by rank growth of the host plants.

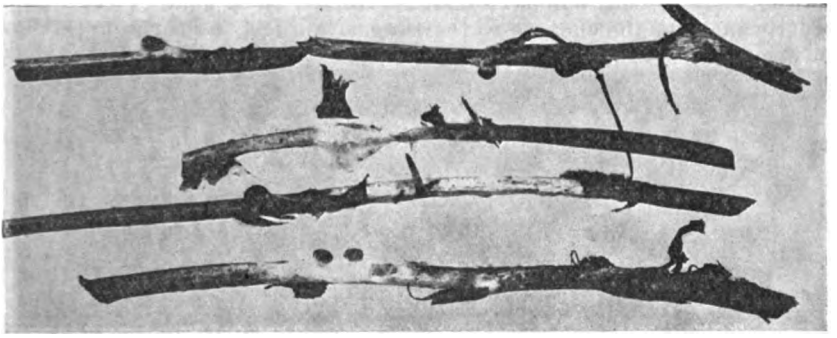

FIG. 2 Stem Rot of Alfalfa. Note the white growth of the fungus and the sclerotia or resting ing bodies. Photo. by F. C. Stewart

Control.—As soon as the disease appears adopt a rotation of crops that will keep susceptible crops off the land for three to five years. Guard against feeding affected plants to stock or distributing infected soil in any way. Be sure before buying that clover or alfalfa seed is free from contamination with the sclerotia. In small plantings where only a few plants are affected it may be worth while to put dry straw on the spots, sprinkle with kerosene oil and burn.

CORN EAR ROT.

Distribution.—This trouble has been reported from all parts of the State, but with most frequency from the mountain section.

The only plant affected is corn.

Symptoms.—Affected ears ripen prematurely, the husks are tight, the ears light in weight, under sized, dark in color, and affected with a dry decay. There is a moldy growth between the grains and over their tips. The corn shelled from affected ears weighs only half as much as that shelled from sound ears of the same dimensions. Very minute black dots can be seen on the affected cobs. Old stalks also show such dark dots just under the rind.

Cause.—This condition is caused by the fungus *Diplodia zeae.* While several other fungi may be responsible for other types of ear rot of corn this is usually the most destructive one. Some of these can attack the ears only when they are harvested before maturity and stored improperly. The fungus in question is an active parasite, and establishes itself on the living corn plant.

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Dissemination.—Old stalks or stubble in the field may carry the disease over from one season to the next. Wind distributes the spores. The storage rots hold over in dirty bins.

Infection.—The *Diplodia* fungus can enter the roots of the plant, grow upward in the stalk, and invade the ear through the shank. Also spores deposited by the wind can infect the young silk and thus reach the ear. The fungous threads enter the seed, but these seed do not germinate, and therefore do not directly transmit the disease. Fields devoted continuously to corn suffer more than others. Wet weather conditions greatly increase the chances of the fungus to affect the corn.

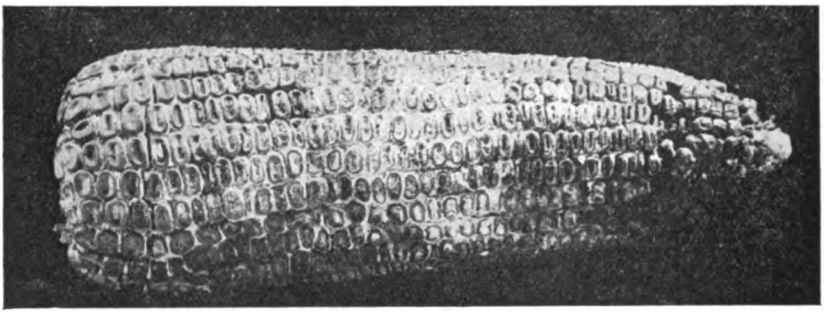

FIG. 3. Corn Ear Rot. Note the white growth of the fungus and the shriveled condition of the grain. Photo. by E. Meade Wilcox.

Control.—Destroy trash in the field as much as possible by fall plowing. Do not plant corn oftener than once in three years in fields or spots where the disease is bad. Be sure that ears are mature before harvesting and are cured before storing. Storage places must be clean, dry and well ventilated. Disinfect old bins or barrels with formaldehyde solution, one pint full strength to forty gallons of water. Feeding moldy corn to stock may bring on serious disease symptoms, and must be done with the greatest caution. It is best not to feed moldy corn at all.

COTTON ANTHRACNOSE.

Distribution in North Carolina.—Anthranose has been reported from the majority of cotton growing counties, from Cleveland and Iredell to the coast, and northward to those bordering on the Virginia line. It has been introduced largely in seed from more southern States where the disease is very widespread.

Cotton is the only plant affected.

Other names for the disease are pink boll and boll rot.

Symptoms.—Bolls develop brown sunken spots that enlarge to about half an inch, and develop a pink growth over the surface. Affected bolls split open prematurely. (See cut on front cover.) In badly affected bolls the lint is rotted or becomes discolored and weak. Seedling plants develop brown ulcers on the seed leaves, or on the lower stem, in which latter case the plants die and the stand may thus be seriously affected. The pinkish growth distinguishes anthracnose from other types of boll rot. Seedling plants may be attacked by *Rhizoctonia,* causing "sore-

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shin," and occasionally by other damping-off organisms; and it is difficult to describe the differences between these and the effects of anthracnose on seedling plants.

Cause.—The disease is caused by the fungus *Glomerella* (*Colletotrichum*) *gossypii*. It may develop inconspicuously on leaf-scars, or other weakened tissues of the cotton plant. In partially affected bolls it may enter the seeds, and will remain dormant in them for several years, resuming its growth when the seeds germinate.

Dissemination.—Seeds from infected bolls are infected internally, and are the chief means of dissemination. External contamination of the seeds by spores may occur from the dripping or splattering of raindrops from affected to sound parts of the plant, or by ginning with machinery that has become contaminated. Because the spores are sticky, and are not easily dislodged when dry, wind does not play an important part in spreading the disease, and it spreads rather slowly from plant to plant in the field. The fungus may persist on old affected stalks in the field for about a year.

Infection.—Bolls may be infected at any time from the blossoming period until they are almost grown. Moist conditions are necessary for this to occur, and the disease is most serious, other things being equal, in wet seasons, or even in the moister parts of a field. Cotton varieties show differences in natural susceptibility; but often the differences noted in the amount of disease in varieties are due mainly to differences in the chances for seed infection the previous year.

Control.—The main thing is to avoid planting infected seed. Unselected seed from a field where the disease has existed will carry the infection. Seed should not be brought from a distance unless assurance can be had of its freedom from infection. No seed treatment can successfully reach the internal infection, and disinfection of the exterior merely is not worth while as a general practice. Seed safe for planting can be secured from a moderately infected field by marking stalks that are not affected and are some yards away from diseased plants, picking these separately, and ginning with a well cleaned gin. If only a small lot of seed can be secured in this way it can be used for starting a seed plat from which clean seed for the general planting can be had the second year. The sound seed must be planted where diseased cotton did not grow the year before; or if necessary to plant cotton in the same field, fall plowing to bury the stalks will render it safe. There is no evidence that cotton seed or cottonseed meal used as fertilizer, or that stable manure plays any important part in the spread of the disease. It does not persist in the soil. Some hold that if infected seed is kept until the second season it will be reasonably safe to plant; but this matter needs further testing.

COTTON "RUST."

Distribution.—This disease is common in light sandy lands of the North Carolina cotton belt.

Cotton is the only crop affected.

The disease is also known as black rust and leaf blight. The name "rust" is somewhat objectionable because it refers more appropriately to diseases caused by the true rust group of fungi.

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Symptoms.—The leaves turn yellow and then brown, becoming dry and dropping from the plants; these are often stunted in growth. It usually occurs in certain sections of a field, all plants in the area showing the condition, which shades off at the borders of the area. The disease is distinguished from wilt by the absence of any discoloration of woody part of the stem, and from root-knot by the absence of the galls. Red spider injury to the leaves is frequently called "red rust," and is an entirely different trouble.

Cause.—This disease is not caused directly by any organism, although certain weak fungi may establish themselves on the already weakened leaves, and perhaps hasten their destruction. The proper functioning of the leaves is deranged through unfavorable soil conditions. These may be: (1) lack of water; (2) lack of drainage; (3) lack of food material, especially potash, and (4) lack of humus. The trouble prevails mostly on light sandy soils, particularly in places where there is a good chance for leaching. Prolonged drouths after heavy rains are apt to develop "rust" prominently on soils of the types indicated.

Control.—Try to determine which ones of the factors enumerated seem to be responsible. Humus may be added in the form of stable manure or of green crops turned under. Use potash and phosphoric acid as a fertilizer at a rate of something like 300 to 800 or more pounds to the acre to supply the plant food deficiencies. Drain wet lands. Deep preparation of the land and frequent shallow cultivations will help to lessen the trouble.

COTTON WILT.

Distribution in North Carolina.—This disease is known to occur in Anson, Davidson, Duplin, Johnston, Lenoir, Mecklenburg, Moore, Nash, Pitt, Richmond, Robeson, Scotland, and Wayne counties. It is probably in small areas in each of these as yet.

Plants Affected.—Cotton and okra.

The disease is known also as blackheart and blackroot.

Symptoms.—The leaves may wilt suddenly, or may turn yellow slowly and drop. Affected plants are usually somewhat stunted in growth, and bolls may be poorly formed. On cutting across the stem dark brown discoloration of more or less of the wood can be seen. Many of the roots are blackened or dead. It may appear at any time after the cotton is about eight inches high.

Cause.—The fungus, *Fusarium vasinfectum,* enters the roots from the soil, grows upward in the sap tubes, discoloring and clogging them, and producing the wilt symptoms.

Dissemination.—The fungus can live in the soil for a number of years and may be transferred in even small amounts of contaminated soil. Light sandy soils offer conditions best for its development. A stable may harbor the fungus in the manure for a long time if once contaminated. Spores are produced on the surface of dead stalks in the field, and some of these may become lodged in the lint, and remain in the fuzz of the seed. But on the whole the chances for seed to act as a carrier seem rather slight.

Infection is through the root system in practically all cases, and is greatly favored by nematode injury to the roots. There is apparently

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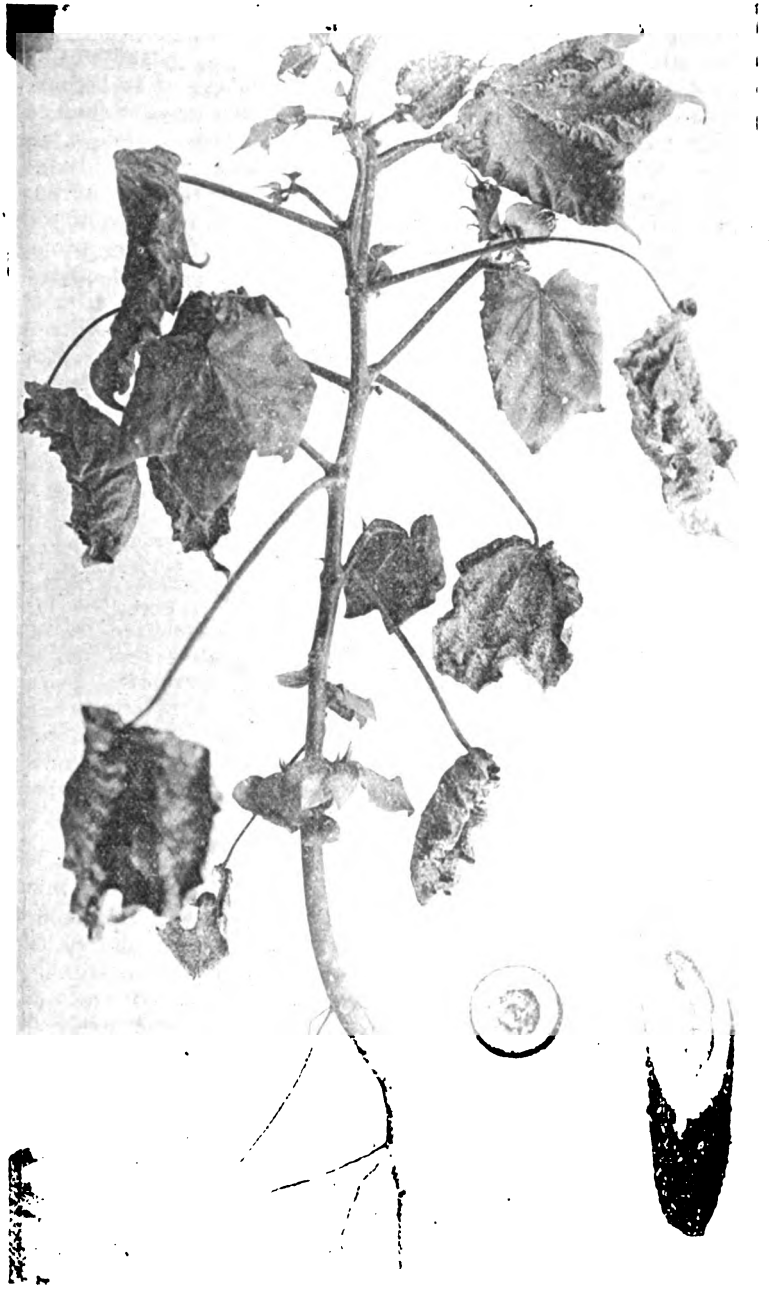

FIG. 4. Cotton Wilt. General effect on young plant, and cross sections of stem on larger scale showing characteristic discoloration of wood. After Orton, Farmers' Bulletin 333, U. S. Dept. of Agriculture.

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no spread in the field except through the soil. This is by the slow growth of the fungus through it, or by any transfer by implements in cultivaton or by other means.

Control.—Do not plant seed that have had a chance to become contaminated externally. Do not allow stock to run on infected land. Clean all implements after using on an infected field. Guard against manure contamination. If only a small area is involved it will be advisable to remove and burn affected stalks. It would be well to fence off such an area and handle is separately. Fertilizers have no influence directly on the disease and good results in crop yield will result from the proper use of them and of uncontaminated manure. Two varieties of upland cotton, Dixie and Dillon, possess a marked resistance to the disease, and may be grown in a proper rotation on infested land. The Dillon seems better adapted to North Carolina conditions. It is an improved strain of Jackson Limbless, with some but not all, of the objectionable features of that type modified. It has produced one and a half bales to the acre under good cultivation on land where other varieties were a total failure because of wilt; and this quality of resistance makes it valuable on wilt infested soils in spite of its being only an average cotton otherwise. Four other varieties that show a considerable degree of wilt resistance and are worthy of trial are Wood (similar to Hawkins), a strain of Covington-Toole, Modella (a selection from Excelsior), and several strains of Cook. Cotton should not be planted on infested land oftener than once in three years. If cotton wilt alone is present, any crops other than cotton and okra may be planted on the land. Frequently nematode root-knot occurs also, in which case crops susceptible to it must be avoided. (See under "Root-Knot of Various Crops," in this BULLETIN.) A suggested rotation* under such circumstances includes winter oats or rye, followed by Iron cowpeas thickly sown; when these are off, the land is put in winter grain again, which may be followed by corn with Iron cowpeas between the rows; a resistant cotton may be planted the third year.

COWPEA WILT.

Distribution in North Carolina.—Reports have been received from Cabarrus, Cumberland, Granville, Johnston, Mecklenburg, Moore, Wake, and Wayne counties.

Cowpea is the only crop affected.

Symptoms—The leaves turn yellow and drop prematurely, beginning with the oldest. Often the stems are left bare except for a few young leaves at the top. If the plants are in a succulent condition, wilting of the leaves may be prominent. Very young plants may rot or damp off near the base. Affected plants are scattered through a field or occur in particular spots. On cutting across the stem a dark brown discoloration of the wood tissue is prominent. Some of the roots are black and dead.

This disease may be confused with nematode injury or with *Rhizoctonia* root rot. The presence of the galls, which must not be confused with the bacterial nodules or tubercles, distinguishes the former; and

*Suggested by W. A. Orton in Farmers' Bulletin No. 333.

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the more superficial development of the rot on the lower stem, and the absence of internal wood discoloration distinguish the latter.

Cause.—This disease is caused by the fungus *Fusarium tracheiphilum.* It is closely similar in form and habits to the fungi causing wilts of cotton, watermelon, tomato, Irish potato, sweet potato, etc. But the cowpea fungus seems not to be able to infect these plants, and the cowpea not to be susceptible to the other wilt fungi. However, two or more of these wilt fungi may sometimes inhabit the same soil. The fungus lives in the soil from year to year and increases with the successive planting of susceptible varieties of cowpeas on the land. It enters the plants through the roots, grows upward in the sap-tubes of

FIG. 5 Wilt of cowpea. The plant on the left shows no evidence of the disease. The other two show advanced stages.

the stems discoloring the wood tissues along its path. The interference with water conduction brings on the symptoms of wilt. After a plant is dead the fungus may grow out to the surface and form a crop of pinkish spores there.

Dissemination.—The chances for the spores to play an important part in the spread of the disease seem relatively slight; and seed probably do not act as carriers, through external contamination, with great frequency. The feeding of infected plants to stock will introduce the disease into the manure, where it flourishes; and by this means it may be scattered over the farm. The fungus remains alive, although dormant, for long periods in thoroughly dried stalks of affected plants, and well cured hay may produce manure contamination. Transfer of infected soil in any way will spread the disease. In using soil for legume inoculation be sure that this and every other soil disease is absent from the field from which it is taken.

Infection.—Infection seems to occur entirely through the roots. Nematode injury furnishes a ready way of entrance for the fungus, and the disease is always worst where nematodes infest the soil along with the wilt fungus. But either trouble may exist independently of the

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other. The Iron variety of cowpea possesses a high natural resistance to the wilt disease as well as to nematode injury. Certain hybrid varieties, such as the Brabham, have been bred with a similar resistance.

Control.—Avoid spreading the disease by means of infected soil or manure. Infected hay, either fresh or cured, is a source of danger to the manure. Cowpea seed from an uncertain source may be treated with formaldehyde solution, one pint of full strength or 40 per cent formaldehyde in forty gallons of water, before planting as a precaution against spore contamination; but it is not certain that this is a common source of danger. Plant the Iron or some other resistant variety of cowpea on infected land. Tests in North Carolina for six years in comparison with thirty varieties give the Iron cowpea a rank of eighth in seed production and of first in hay production.

GRAIN RUSTS.

This discussion has reference to four species of rust, (1) the stem rust or black rust of wheat, oats, and rye (*Puccinia graminis*); (2) the leaf rust or orange rust of wheat (*Puccinia rubigo-vera tritici*); (3) the leaf rust or orange rust of rye (*Puccinia rubigo-vera secalis*); and (4) the leaf rust or crown rust of oats (*Puccinia coronata*). Besides

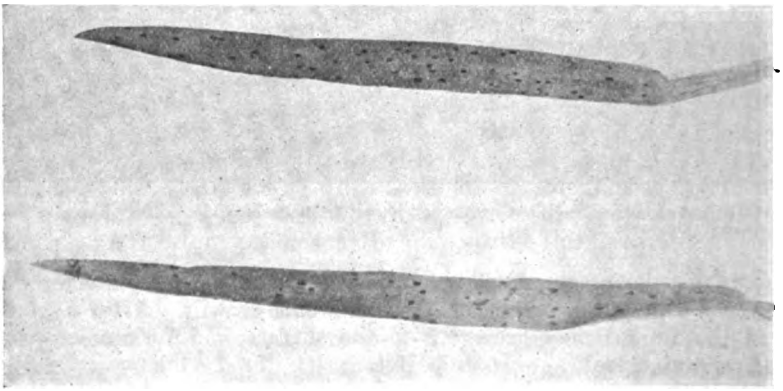

FIG. 6. Leaf Rust of Rye. The granular appearance of these summer spore pustules does not show distinctly in the photograph.

these, barley is attacked by the stem rust named above, and in addition by a leaf rust; and corn is attacked by still another species. These last are omitted from discussion because of their less economic importance.

Any one of the four forms under discussion may be expected on the appropriate crop in any section of the State, although there is considerable seasonal and local variation in the amount of each.

Symptoms.—Small, elongated spots with a powdery appearance and a reddish-yellow or orange color, are the conspicuous features of these rusts. Sometimes the term "rust" is applied erroneously to any disorder that produces discoloration of the leaves. The stem rust develops on stems and sheaths more frequently than on the blades; and in its later development on maturing plants produces prominent granular black

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streaks. It is by far the most destructive type of rust, and at the same time the one least commonly seen. The three leaf rusts, as their name implies, attack the blades most conspicuously. Their later stage of development consists of very minute black dots that are buried just beneath the surface of the leaves.

Life Histories.—The life histories of the four types are similar. In the bright colored spots the socalled *summer spores* are formed. These are rather short-lived, and can infect other grain plants of the proper species, as well as certan wild grasses. On these last, or on volunteer grain the fungus may persist until the winter grains are up. Inside the tissues of these or of overwintering wild grasses the rusts can survive until the next season, growing slowly, forming spores, and causing new infection as the weather permits. Rapid spread comes again with moist spring weather.

The dark spots on the maturing plants produce the so-called *winter spores.* These are long-lived and regularly survive the winter. On germination the next spring they give rise to delicate infection spores that have the peculiarity of being able to infect, not the proper grain or grass species, but some other entirely different plant, as the barberry, on its leaves, in the case of the stem rust. On such a plant still another type of spore is produced rather early in the season, and it will carry the disease back to the grain crops. However, this more complicated cycle is not necessary for the persistence of the disease, and in most cases the overwintering is simply in infected plants as indicated in the preceding paragraph.

Wind is the important agent in disseminating the spores of these rusts.

Infection.—Weather conditions influence infection greatly. Cool, dewy nights and humid, misty days, when plant parts remain wet for twelve hours or more, furnish the best conditions for spore germination. Luxuriantly growing plants, because of their succulence, longer growth period and slow drying after showers, suffer much from rusts. Low, heavy, moist places in the field are favorable for rust infection. Some varieties, as the durum wheats of the semi-arid West and the rust-proof oats of the South are satisfactorily resistant; and careful breeding work is now in progress to develop other resistant types.

Control.—Try to secure early and uniform maturing of the crop, before the period of greatest rust development. Fall planted grain may escape when spring planted crops would be severely affected. Select early varieties, sow plump, uniform seed of good vitality in land that has been well prepared. Avoid excessive nitrogenous fertilizing that will produce rank, succulent growth. Do not sow thick enough to produce excessive shading. Sow on land of proper soil texture and drainage. Keep down as much as possible volunteer grain and such wild grasses as favor the development of any rust.

GRAIN SMUTS.

Four grain smuts are considered here: Oat smut, stinking smut of wheat, loose smut of wheat, and corn smut. All are caused by distinct fungi. No one of these fungi can attack other plants than the host indicated.

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FIG. 7. Smut of Oats. The characteristic dwarfing of affected plants, and the infection of the entire stool are very apparent.

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Distribution in North Carolina.—Oat smut occurs in varying amounts all over the State.

Stinking smut of wheat has been reported from about one-fourth the counties in the wheat-growing part of the State. It occurs typically in restricted areas.

Loose smut of wheat occurs generally wherever wheat is grown.

Corn smut has been reported from all sections of the State.

Symptoms.—Oat smut changes the heads into a black powdery mass before they shoot out from the sheaths. The grain and usually the chaff are destroyed. The dusty mass is scattered, leaving a bare stalk.

FIG. 8. Stinking Smut (left) and Loose Smut (right) of Wheat. Note the dark interior of the broken grains attacked by stinking smut. Two normal grains are shown below for comparison.

Stinking smut of wheat converts the inside of the grain into a dark powdery mass that has a disagreeable odor. The grains are small, swollen, brown and light; but their hulls and the chaff are not affected. The heads stand erect in the field as the crop matures, and the chaff and awns may spread unnaturally; otherwise the heads are not conspicuously abnormal.

Loose smut of wheat converts the grain and chaff entirely into a smut mass, and the spores are soon shed, leaving a bare stalk, very much as in oat smut.

Corn smut is characterized by the prominent swellings at first whitish and moist, later becoming dry, black smut masses. These occur

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on the aërial roots, the leaves, the stalk, the ears and the tassel. They may reach large size, but sometimes are so small as to be readily overlooked.

Cause.—Oat smut is caused by the fungus *Ustilago avenae;* stinking smut of wheat by *Ustilago foetans;* loose smut of wheat by *Ustilago tritici;* and corn smut by *Ustilago zeae.* The fungi grow in the tissues of the plants, drawing nourishment from them, but not giving external evidence of their presence until conditions are suitable for their fruiting, when they form the striking masses of dust-like spores.

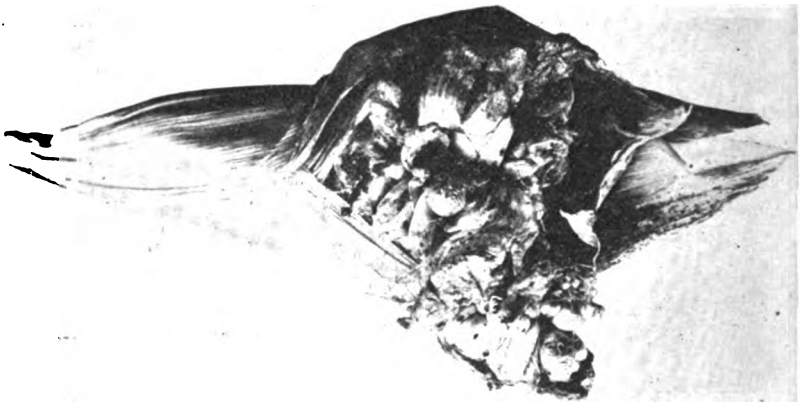

FIG. 9. Smut of Corn. Ear infection, with the grains enlarged and distorted.

Dissemination and Infection.—The dark dust-like spores disseminate all of these, but in rather different ways. Oat smut and wheat stinking smut spores lodge on the grain in the field or become mixed with it in threshing, remain alive on the surface of the seed during storage, germinate with the seed on planting, and form infection spores that enter the very young oat or wheat sprouts just after they emerge from the seed, and before they have appeared above ground. This very early period is the only one when infection by these two smuts can occur. Once inside the young sprout these fungi grow upward in the growing points and become established in many or all of the buds that produce shoots in the stool. No effect is seen until the smutted heads appear, months after the infection of the plants.

Spores of loose smut of wheat, on being scattered, may sift into the open flowers of nearby heads. The spores germinate immediately in the moisture there, and the fungus grows directly into the very young seed, and establishes itself in the tissues as the grain passes through the milk and dough stages, becoming dormant as it reaches maturity. The fungus remains alive inside the seed during storage, and resumes growth in the seedling plants. It, too, grows upward in the shoots, and is first apparent in the smutted heads.

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Corn smut spores sprout on the moist surface of the ground, and form a number of infection spores that are carried by the wind, and may attack any tender above-ground part of the plant with which they come in contact. In manure, or on heavily manured ground these infection spores are formed in large numbers and for a long period. Moisture favors infection greatly by giving a chance both for the infection spores to be produced on the ground and for these to germinate and enter the tender plant parts. Sweet corn is much more susceptible than field corn varieties. Rank growth of the stalks favors infection both because of the delayed drying of the ground surface and because of the succulent tissue.

Control.—Control measures for these three classes of smuts depend on the modes of infection. In oat smut and stinking smut of wheat spores lodged on the surface of the seed are the source of danger. These two smuts can be easily prevented by external disinfection of the seed at any time before planting. Dipping in bluestone solution, one pound to four gallons of water, is effective; but it is apt to injure the germination of the seed, particularly of oats. A better disinfectant is formaldehyde. Dilute the full strength preparation of this (rated at 40 per cent, and sometimes known as formalin) at the rate of one pint to forty gallons of water. Sprinkle the seed pile, shoveling it over until every one is thoroughly wet. Cover with cloths for two hours, and then spread out so as to dry rapidly. Before treating wheat for stinking smut dip the seed in water, stir thoroughly and skim off the smut balls. Treated seed may be planted as soon as dry, or later. Store in disinfected bins. Once in three years is ordinarily often enough to use this treatment when home-grown seed is planted.

In the case of loose smut of wheat the seed infection is internal, and can not be reached by external applications. Uninfected seed must be planted to avoid the disease. Sometimes clean seed may be obtained from unaffected fields. Frequently it will have to be grown in a special seed plot away from other wheat fields. Such a plot must be watched closely at heading time so that every smutted stool may be pulled up and destroyed before the spores scatter. In this way clean seed for next year's general planting can be had, and if the seed for the plot is selected from superior plants, the strain of wheat can be improved at the same time. There is a method of hot water treatment that destroys most of the internal infection of loose smut of wheat, but the process injures germination to some extent, is very slow, and requires unusual care. The seed grain is soaked four to six hours in water at ordinary temperature, and is then dipped for ten minutes in loose bags in lots of not more than a peck in water held within a fraction of a degree of 129° Fahrenheit. This method is useful for insuring safe seed for planting a seed plot.

Corn smut is not carried either on or in the seed, and no seed treatment is effective. There is no direct means of control, but several things may reduce its prevalence. Avoid feeding smutted material to stock lest the manure become contaminated. Do not use manure too freely on land where corn smut prevails; compost it well or apply it as far ahead of the corn crop as possible. Do not plant corn too close, especially on soils that hold moisture or produce rank growth. Culti-

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vate as soon after rains as possible so as to hasten the drying of the surface soil. In some cases, as with a sweet corn crop, it will pay to cut out and bury or burn the first formed smut masses when the farthest advanced are full size, but have not yet turned black and broken open. This will usually be a little before tasseling time. Destroy the smut masses in the field after harvesting, and rotate crops. The spores are probably killed in the silo, and the presence of smut in ensilage is not dangerous. The dry spores may irritate the digestive tract of stock, but seem not to have directly toxic properties.

The loose smut of barley is similar in characteristics and control to the loose smut of wheat, and the covered smut of barley and the kernel smut of sorghum are similar to the stinking smut of wheat.

TOBACCO WILT.

Distribution in North Carolina.—This disease has been known in Granville County for many years and is commonly referred to as the Granville wilt. The infected area there lies mainly between the Neuse

FIG. 10. Wilt of Tobacco. The picture shows the destructive effects of the disease, and something of the appearance of plants in advanced stages.

and Tar rivers, and has progressively increased until practically all the Granville coarse sandy loam type of soil is now infected. The disease also has been reported on tobacco as occurring scatteringly in Durham, Wake, and Vance counties, and probably in Greene County. On its other host plants, particularly tomato, it has been reported from Alexander, Bladen, Burke, Carteret, Columbus, Duplin, Durham, Franklin, Gates, Granville, Iredell, Mecklenburg, Randolph, Sampson, Vance, Warren, Wake and Yadkin counties.

Plants Affected.—Tobacco, tomato, Irish potato, pepper, egg-plant, peanut, jimson weed, black nightshade, and ground cherry are susceptible, as doubtless are a considerable number of other wild plants.

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Symptoms.—Individual leaves become pale and misshapen, frequently on one side of the mid-rib, and droop. In time the whole plant may be involved. The stem may show on external view elongated streaks, dark and somewhat sunken. On cutting across the stems very dark areas are seen in inner bark, wood ring or central pith. On squeezing a cut stem a milky fluid exudes from the darkened areas, which is quite different from the normal clear watery sap. The root system shows a number of dead and blackened roots.

On tomato and Irish potato this disease may be confused with the *Fusarium* fungous wilts that attack these plants. The exuding of the milky fluid is a distinctive mark of the bacterial disease.

Cause.—It has been proven beyond question by several workers that this disease is caused by bacteria of the species *Bacterium solanacearum.* They make up the milky fluid referred to above. Some of this fluid from a diseased plant introduced by a needle puncture into young tissue of a healthy plant will produce symptoms of the disease in one to several weeks, depending on the rapidity of increase of the bacteria. The organisms may persist in the soil for a number of years, but do not increase markedly unless susceptible plants are allowed to grow. These bacteria are themselves plants, and their ability to maintain themselves in the soil is influenced by the physical structure, chemical composition, water content, aëration, temperature and doubtless other conditions of the soil, just as crop plants are influenced by such factors. When more exact knowledge is obtained about the special requirements of these bacteria it may be possible to handle or treat the soil in such a way as to hinder their development without interfering with tobacco production.

Dissemination.—These bacteria may be spread through any transfer of infected dirt, commonly by water washing the soil, by farm implements carrying it up and down the rows in cultivation, or from one field to another, by animals carrying it on their feet, and by adherence of dirt to the roots of plants of any sort transplanted from infected spots. It is possible that the blowing about of dust may convey it, but the vitality of the organism is affected very unfavorably by drying. The disease may start in the seed bed, and be carried to the field in plants already slightly infected there. Insects that feed on affected plants and afterwards on sound ones may infect the latter through the wounds by means of bacteria smeared on their mouth parts. In topping and suckering the disease may be conveyed from sick to healthy plants. All of these agencies naturally spread the infection over rather short distances, and it is a characteristic of the disease that it travels slowly. It is possible that manure, or tobacco seed, or cured leaves or dried stalks that have been affected may play a part at times in its dissemination, but direct evidence for this is lacking at the present, and the inability of the organisms to withstand prolonged drying makes the matter questionable.

Infection.—In most cases the organisms enter the plants from the soil through some of the smaller roots and work upward in the plant. This may occur in the seed bed, at transplanting, or later. Injury to the roots at transplanting and nematode attack furnish ready means of entrance. Insect injuries and the wounds made in topping and sucker-

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ing have been referred to. Some have held that too much nitrogen fertilizer predisposes the plants to the wilt, and that a relatively large amount of potash will have the opposite effect. There is no conclusive evidence that the fertilizers commonly used in tobacco culture greatly favor the disease; certainly they alone do not cause it. Rainy weather and low, moist situations are favorable to the progress of the disease.

Control.—Make the seed bed in uninfested spots. The common practice of using newly cleared land and burning it well is a safeguard. Make sure that drainage water from infected fields can not reach the seed bed. Such water is not safe for use in transplanting; on the seed bed it may undo the work of sterilizing by burning the bed. If there is any suspicious development in the seedling plants do not use any for setting in uninfested fields. Be very cautious about using plants grown by other people. By early transplanting much of the loss is sometimes avoided. Avoid root injury in transplanting and cultivation. Guard against any transfer of infected soil on farm implements or vehicles or the feet of stock. Clean the implements; disinfectants may sometimes be used on them to advantage, such as formaldehyde, 1 pint in 8 gallons of water, or carbolic acid, 1 pint in 5 gallons, or bluestone, 1 pound in 4 gallons. In infected fields try to control insects to the fullest extent. Remove and destroy affected plants in as far as possible; each one harbors enough bacteria to kill hundreds of others if given the chance. Do not let any contaminated refuse reach the barnyards or roads or streams. It is important to prevent surface drainage from infected fields to valuable land. Handle sound plants before affected ones in topping and suckering, and do this work in dry weather. Do not plant tobacco or other susceptible crops on infected soil for four to six years. Crops that require clean cultivation, such as corn or cotton, are probably best in the rotation. Be sure that susceptible weeds are kept from growing.

The following rotations* might be practiced with profit:

For land slightly infected: 1. Tobacco, followed by winter oats. 2. Cowpeas, followed by crimson clover. 3. Cotton, with crimson clover sowed at last working or first picking. 4. Corn, followed by winter rye. 5. Tobacco, followed by winter oats.

For land badly infected: 1. Tobacco, followed by crimson clover. 2. Corn, followed by crimson clover. 3. Cotton, followed by crimson clover. 4. Corn, followed by winter oats. 5. Cowpeas, followed by grass mixture after liming. 6. Grass,† followed by winter rye. 7. Tobacco, followed by crimson clover.

Attempts are being made to develop types of tobacco resistant to the disease, but these have not yet given desired results.

No practicable method of soil disinfection has been devised. Badly affected plants are hardly good for anything except the making of tobacco extract. The early harvesting of a crop may sometimes avoid increased loss.

*Outlined by Mr. E. G. Moss, Co-operative Assistant in Tobacco Investigations.
†It may sometimes be best to keep the land in grass two years, thus lengthening this rotation.

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ROOT KNOT OF VARIOUS CROPS.

Distribution in North Carolina.—This trouble occurs in sandy types of soil in the eastern half of the State.

Field Crops Affected.—Alfafa, vetch, soy bean, clovers, cowpeas (except Iron), cotton, tobacco, potato, sweet potato, watermelon, cucumber, cantaloupe, and tomato. Many other crop plants are affected as well. A few of the common weeds that are susceptible are May-pop, wild potato, pigweed, purslane, morning glory, and wild carrot.

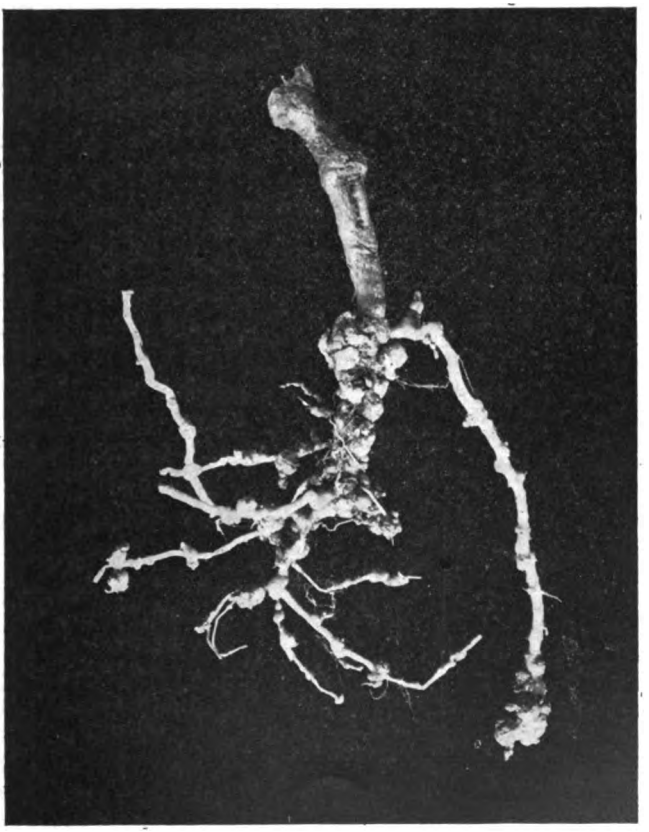

FIG. 11. Nematode Root-knot. A badly affected root-system, showing the irregular swellings of various sizes.

Symptoms.—Enlargements of irregular shape and size appear anywhere on the root system. These swellings involve the whole thickness of the root, and are not merely outgrowths from the side as are the bacterial nodules of leguminous crops. Affected plants are stunted in growth and their foliage is a lighter shade of green than normal; this, however, may be hard to detect when a large area is uniformly infected. Badly affected plants may wilt when water is scant, or sometimes in the hot sun when there is an abundance of moisture in the soil.

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Cause.—This trouble is caused by a species of microscopic worm, *Heterodera radiciola,* belonging to the group of Nematodes. The females are very much enlarged during egg-laying, and may be barely seen on breaking across a knot as pearly white bodies one-half the size of a pin-head. The worms may live in the soil for months, but quickly die in galls after the death of the plant. A generation, from egg to egg, is about a month, and a female usually lays several hundred eggs. To flourish in the soil the organism requires: (1) warmth, (2) loose texture of the soil, (3) moderate moisture, and (4) proper food plants.

Dissemination.—The worms can live over winter in the more protected parts of the soil, or in the galls on perennial plants. They are readily transported to distant places in infected nursery stock, mainly fig, peach or mulberry, or in the roots or adhering soil of annual plants for transplanting, or in Irish potato tubers for seed. For shorter distances the usual agencies are running water that washes the surface soil, hoofs of animals, wheels of vehicles, farm implements, and men's shoes. Possibly winds and manure may be less successful disseminators. The worms can move through the soil, but at a rate of only a few feet a season.

Infection.—The larval worms enter the young tips of the roots, and the irritation they set up causes the gradual development of the gall as the part grows older. The list of susceptible plants includes several hundred of all sorts of plants. The field crop plants that are practically resistant are rye, winter oats, wheat, corn, peanut, Iron cowpea, and velvet bean. Crab-grass and beggarweed are also highly resistant.

Control.—Avoid transfer of infected soil. Regulate washing of soil by using embankments. Clean implements in going from an infested spot. Areas can be most quickly cleared of the infestation by keeping the land absolutely bare for two years. But many soils can not be treated thus, and the method is expensive. The next most effective one is to plant for two years in resistant crops, as winter rye or oats followed by Iron cowpeas or peanuts or velvet beans; and repeat the second year. Susceptible weeds must not be allowed to grow. If a winter grain is omitted, plow in the fall, cultivate bare the next spring until time to plant the resistant legume. Some reduction can be accomplished by breaking the land deep in dry weather and allowing it to dry out as much as possible. Allowing the land to grow up thick with crab-grass is good. Proper fertilization to make up for soil deficiencies has a good effect on the crop and may enable it to develop in spite of the nematodes.

LEAF TOBACCO SALES FOR MARCH, 1913.

Pounds sold for producers, first hand	1,669,630
Pounds sold for dealers	165,661
Pounds resold for warehouses	130,947
Total	1,966,238

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THE BULLETIN

OF THE

NORTH CAROLINA

DEPARTMENT OF AGRICULTURE

RALEIGH

Volume 34--No. 4. SUPPLEMENT, APRIL, 1913. Whole No. 183

ANALYSES OF ILLUMINATING OILS

BY

GARLAND JONES, Jr., State Oil Chemist

SENT FREE TO CITIZENS ON APPLICATION.

Entered at the Post-office at Raleigh, N. C., as second-class matter, February 7, 1901, under act of June 6, 1900.

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DIVISION OF OIL INSPECTION

W. A. GRAHAM	Commissioner.
ELIAS CARR	Secretary.
GARLAND JONES, JR.	State Oil Chemist.

SIR:—I submit herewith manuscript covering analyses of illuminating oils sampled during the first three months of the current year. I recommend that it be published as a supplement to the April BULLETIN.

Respectfully submitted,

GARLAND JONES, JR.,
State Oil Chemist.

To HON. W. A. GRAHAM,
Commissioner of Agriculture.

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AN ACT TO PROVIDE FOR THE INSPECTION OF ILLUMINATING OILS AND FLUIDS.

[Chapter 554, Public Laws of 1909, as amended by Public Laws of 1911, Chapter 143.]

The General Assembly of North Carolina do enact:

Oils subject to inspection and test.

SECTION 1. That all kerosene or other illuminating oils sold or offered for sale in this State for illuminating purposes shall be subject to inspection and test to determine the safety and value for illuminating purposes. All manufacturers, wholesalers and jobbers, before selling or offering for sale in this State any kerosene or other oil for illuminating purposes, shall file with the Commissioner of Agriculture a statement that they desire to do business in the State, and furnish the name or brand of the oil or oils which it is desired to sell, with the name and address of the manufacturer, and that the oil or oils will comply with the requirements of this act. The Department of Agriculture shall have power at all times and at all places to have collected samples of any illuminating oils offered for sale, and have the same analyzed. The inspection of oils, as authorized in this act, shall be under the direction of the Board of Agriculture, which is authorized to make all necessary rules and regulations for the inspection of such oils and to adopt standards as to safety, purity or absence from objectionable substances and luminosity when not in conflict with the provisions of this act and which they may deem necessary to provide the people of the State with satisfactory illuminating oil.

Statement to be filed.

Power to collect and analyze samples.

Rules and regulations.

Standards.

Appointment of inspectors.

SEC. 2. The Board of Agriculture shall appoint such number of oil inspectors as will be necessary, not exceeding five whose compensation shall be four dollars per day and expenses while on duty. Each inspector, before entering upon his duties, shall take an oath of office before some person authorized to administer oaths. The inspector shall have power to examine all barrels, tanks or other vessels containing kerosene or other illuminating oils, to see that they are properly tagged as required in this act, and they shall, as directed, collect and test samples of oil offered for sale in different sections of the State, and when instructed collect and send samples to the Department of Agriculture for examination.

Salary.

Inspectors to qualify.

Examination of vessels containing oil.

Collection and test of samples.

Tax on oils.

SEC. 3. For the purpose of defraying expenses connected with the inspection, testing and analyzing oils in this State, there shall be paid to the Commissioner of Agriculture a charge of one-half cent per gallon, which payment shall be made before delivery to agents, dealers or consumers in this State. Each barrel, tank, tank car or other container of oil shall have attached thereto a tag or stamp stating that all charges specified in this section have been paid; and the Commissioner of Agriculture, with the advice and consent of the board, is hereby empowered to prescribe a form for such tags: *Provided*, that they shall be such as to meet the requirements of the trade in oils, and to adopt such rules and regulations as will insure the enforcement of this law. Where oil is shipped in tank cars or other larger containers, the manufacturer or jobber shall give

Vessels containing oil to be stamped.

Form of tags.

Notice of shipments.

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notice to the Commissioner of Agriculture of every shipment, with the name and address of the person, company or corporation to whom it is sent, and the number of gallons, on the day the shipment is made.

Oil inspection fund.

SEC. 4. All moneys received under the provisions of this act shall be paid into the State Treasury and kept as a distinct fund, to be styled "the oil inspection fund." All checks or orders in payment for tags or stamps shall be made payable to the State Treasurer. The Commissioner of Agriculture is authorized to draw out of said fund, upon his warrants, such sums as may be necessary to pay all expenses incurred in connection with this act, including salary of oil chemist or chemists, cost of inspection, tags, blanks, etc.

Warrants for payment of expenses.

Surplus to general fund.

SEC. 5 The State Treasurer shall, on the first day of June and December each year, turn into the general fund of the State all moneys of the oil fund in his hands in excess of the amount drawn out by the Commissioner of Agriculture for expenses.

Report to General Assembly.

SEC. 6. The Commissioner of Agriculture shall include in his report to the General Assembly an account of the operations and expenses under this act.

Tests for safety and luminosity.

SEC. 7. Whenever a complaint is made to the Department of Agriculture in regard to the illuminating qualities of any oil sold in this State the commissioner shall cause a sample of said oil or oils complained of to be procured and have the same thoroughly analyzed and tested as to safety and illuminating qualities. If such analysis or other tests shall show that the oil is either unsafe or of inferior illuminating quality, its sale shall be forbidden and report of the result or results be sent to the party making the complaint and to the manufacturer of said oil.

Sale of oil forbidden.

Acts declared misdemeanors.

SEC. 8. Every person who shall fraudulently brand or stamp any package or barrel or other vessel, or use a stamp a second time, or keep any kerosene or other illuminating oil not marked and branded in accordance with the regulations of the Board of Agriculture, or violate any other provision of this act or any regulation adopted by the Board of Agriculture for its enforcement, shall be guilty of a misdemeanor and fined not less than two hundred dollars ($200) for each offense nor more than one thousand dollars ($1,000).

Punishment.

Sale or offer of oil not tagged a misdemeanor.

SEC. 9. If any person, manufacturer or dealer shall sell or offer for sale in this State any of said illuminating oils and fluids before first having the same labeled and tagged as required by the regulations adopted by the Board of Agriculture, he shall be guilty of a misdemeanor and on conviction be fined not exceeding three hundred dollars ($300), and the said oils and fluids be forfeited and sold, and the proceeds thereof go to the common school fund of the State. If any manufacturer or dealer of said illuminating oils or fluids shall, with intent to deceive or defraud, alter or erase the label or tag to indicate a different flash test, gravity or quantity than is indicated by the label or stamp attached to the vessel, he shall on conviction be fined not exceeding fifty dollars ($50) for every such offense.

Punishment.

Punishment for alteration or erasure of label.

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SEC. 10. Any inspector who, while in office, shall be interested, directly or indirectly, in the manufacture or vending of any of the illuminating oils, shall be guilty of a misdemeanor, and on conviction shall be fined not less than three hundred dollars ($300). Inspector interested in manufacture or vending oil misdemeanor. Punishment.

SEC. 11. All prosecutions for fines and penalties under the provisions of this act shall be by indictment in a court of competent jurisdiction. Prosecutions.

SEC. 12. The provisions of this act shall not apply to the retail dealer in oils unless such retail dealer shall sell or offer to sell oils of a manufacturer, wholesaler or jobber who refuses to comply with the provisions of this act. Retail dealers.

SEC. 13. This act shall be in force from and after July first, one thousand nine hundred and nine. When act effective.

Ratified this the 8th day of March, A. D. 1909.

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REGULATIONS OF THE DEPARTMENT OF AGRICULTURE CONCERNING ILLUMINATING OILS AND FLUIDS.

[Chapter 554, Public Laws of 1909, as amended by Public Laws of 1911, Chapter 143.]

1. The statement required of manufacturers and others desiring to sell oil in this State, in section 1 of this act, shall be in substance as follows:

COMMISSIONER OF AGRICULTURE,
Raleigh, N. C.

The..... desires to sell in North Carolina the following brands of illuminating oils:

(1) (Name) .....

(2) (Name) .....

Manufactured or sold by....., whose address is..... P. O..... And it is stipulated that said oils shall comply with the requirements of chapter 554, Laws of 1909, and the regulations of the Board of Agriculture made by authority of said act.

(Signature).....

2. There shall be placed upon each tank car before the same is emptied, and upon all other original packages, tax stamps as required in section 3 of chapter 554, Laws of 1909; also the name under which the oil is sold, the name of the manufacturer or wholesale dealer and the date of filling. No tax stamps shall be required upon a vessel filled from a container upon which the tax has been paid, but same must show the amount of oil it contains, the location of the tax-paid container from which it was filled, and the date of filling.

Where wagons are filled from stationary tanks they must have attached the location of such tanks, and all invoices for oil to retail dealers delivered from such wagons shall show the name of station from which operated and number of gallons sold.

3. Where oil is brought into this State in wagons, each wagon must have stamps attached to cover the amount of oil it contains, and with each and every sale in this State from such wagons there must be given a statement, invoice or tag, showing the name of the company operating the wagon, number of the wagon, quantity of oil sold and date of sale.

Where oil is brought into this State in wagons which also contain oil for sale in other States, a separate compartment must be provided in such wagons for oil sold or offered for sale in North Carolina, and stamps must be attached to said compartment to cover the amount of oil it contains; and with each and every sale in this State from such compartment there must be given a statement, invoice or tag, showing the name of the company operating the wagon, number of the wagon, quantity of oil sold and date of sale. Unless this separate compartment is provided, oil companies will have to pay the tax on all oil brought into this State in wagons.

4. By authority of section 2 of said act, there shall be appointed five inspectors.

5. Each inspector shall examine tank cars, barrels, drums, cans and other containers as directed by the Commissioner; see that the law and regulations are fully complied with, and collect samples as directed and send to the Department for analysis by the State Oil Chemist.

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6. Each inspector shall receive four dollars per day and actual expenses while at work.

7. The Commissioner of Agriculture shall have prepared tax stamps of such denominations and in such quantities as may be deemed necessary to execute this act. The Secretary of the Board shall have charge of these stamps and deliver to the Oil Clerk from time to time such amounts as will be necessary to supply the demand, and shall make settlement quarterly of the amounts of tags disposed of.

8. A barrel shall be estimated to contain fifty-two (52) gallons and a 26-cent stamp will be received as payment of tax on contents of same, unless it shall appear that barrels in excess of fifty-two gallons are generally used by any dealer or company. In that case, tax for the total gallonage of each barrel will be required.

9. All kerosenes or other oils usually used for illuminating purposes offered for sale or sold in this State for other use shall have plainly marked on the container in letters at least two inches high, or plainly printed on a tag attached thereto, "Not for Illuminating Purposes. Highly Inflammable." Such oil is not subject to taxation. Using or selling it for illuminating purposes shall be a violation of section 8 of this act.

10. Shipment by car-load lots of oil in barrels, drums or other containers shall be reported to the Commissioner, as is required for shipment in tank cars or other large containers by section 3, chapter 554, Laws of 1909.

11. No person shall offer to a common carrier for shipment empty containers used for illuminating oils upon which the tax stamps have not been canceled.

12. The flash test of illuminating oils shall not be less than 100 degrees Fahrenheit, as tested by the Elliott method—closed cup—according to directions prepared by the State Oil Chemist. Illuminating oils which flash below 175° Fahrenheit in the Elliott closed cup shall not contain more than 6 per cent by weight of residue remaining undistilled at 570° Fahrenheit when distilled according to directions prepared by the State Oil Chemist; except that oils of not less than 47° Baumé at 60° Fahrenheit shall not contain more than 10 per cent of residue by weight.

13. The record of the tank-car book furnished by the railroad companies as to the capacity of each tank car will be accepted by the Department.

14. The State Oil Chemist shall analyze such samples as deemed necessary to ascertain safety and objectionable substances, purity and luminosity, and report to the Commissioner of Agriculture any standards he deems advisable to be established in these particulars.

15. The Commissioner, with the approval of the Police Committee, may suspend or change any of these regulations until the ensuing meeting of the Board.

W. A. GRAHAM,
Commissioner.

RALEIGH, N. C., August 1, 1913.

ANALYSES OF KEROSENE.

With proper care a kerosene lamp is a perfectly safe form of lighting and gives a light of good quality. Most accidents are not due to explosions within the lamp, but to dropping or breaking the lamp while it is lighted, or to the use of gasoline instead of kerosene in the lamp by mistake.

The poor quality of light experienced by some users of kerosene lamps may be due to several causes: To a poor quality of oil or a dirty and clogged burner, a misfitting or poor wick, or a badly fitted chimney. The inspection by the Department of Agriculture assures to the consumer in this State a good quality of oil.

In regard to the other conditions the following suggestions are offered:

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SUGGESTIONS FOR THE CARE AND USE OF KEROSENE LAMPS.

The wick should be of proper size for the burner employed. It should be long enough to reach the bottom of the oil container. It should be thoroughly dried before use and immediately soaked in oil. It is better to change wicks after two months use.

The chimney should be of the proper size and care should be taken that the chimney is held tightly enough so as not to fall off when the lamp is moved.

The burner should be cleaned thoroughly once a month and all pieces of burnt wick, dead insects and dirt should be removed every day. It is very important to keep the air holes in the burner open.

Always fill the lamp by daylight and never while the lamp is burning. See that the cap is screwed in before lighting. The burnt crust of the wick should be removed each day before lighting.

Refill the lamp before all the oil in the container is consumed. It is best to keep the lamp well filled, as the oil feeds to the wick better then and there is less danger of gas being formed in the container.

In extinguishing a light never blow down the chimney, but blow across the top, or better still, place a small card or piece of tin on top of the chimney.

Care should be taken to place the lamp in a secure place and never on a rickety table or place where it may be easily upset.

NEVER POUR OIL ON A FIRE.

METHODS OF ANALYSIS.

The flash point was determined with the Elliott Closed Cup Tester. The test was applied according to the following directions:

"Remove the oil cup and fill the water-bath with cold water up to the mark on the inside. Replace the oil cup and pour in enough oil to fill it to within one-eighth of an inch of the flange joining the cup and the vapor-chamber above. Care must be taken that the oil does not flow over the flange. Remove all air bubbles with a piece of dry paper. Place the glass cover on the oil cup, and so adjust the thermometer that its bulb shall be just covered by the oil.

"If an alcohol lamp be employed for heating the water-bath, the wick should be carefully trimmed and adjusted to a small flame. A small Bunsen burner may be used in place of the lamp. The rate of heating should be about two degrees per minute, and in no case exceed three degrees.

"As a flash torch, a small gas jet one-quarter of an inch in length should be employed. When gas is not at hand employ a piece of waxed linen twine. The flame in this case, however, should be small.

"When the temperature of the oil has reached 85° F. the testings should commence. To this end insert the torch into the opening in the cover, passing it in at such an angle as to well clear the cover, and to a distance about half-way between the oil and the cover. The motion should be steady and uniform, rapid and without any pause. This should be repeated at every two degrees' rise of the thermometer until the thermometer has reached 95°, when the lamp should be removed and the testings should be made for each degree of temperature until 100° is reached. After this the lamp may be replaced if necessary and the testings continued for each two degrees.

"The appearance of a slight bluish flame shows that the flashing point has been reached.

"In every case note the temperature of the oil before introducing the torch. The flame of the torch must not come in contact with the oil.

"The water-bath should be filled with cold water for each separate test, and the oil from a previous test carefully wiped from the oil cup."

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The distillation test was carried out by the continuous Engler method as modified for the official residue test:

"A weighed Engler flask, containing 100 cc. of illuminating oil, is protected by a layer of asbestos on the bulb and neck. A thermometer is inserted in the usual way so that the upper part of the mercury bulb is opposite the lower part of the side neck of the flask. The distillation is conducted in the regular manner over a Bunsen flame, the heat being regulated so as to distill the oil as evenly as possible over a period of approximately 25 minutes. The time of distillation is counted from the time the first drop leaves the condenser until the burner is finally extinguished and removed. The temperature is brought up to the actual corrected temperature of 570 degrees Fahr. a second time after cooling at least 30 degrees Fahr. The corrected temperature is obtained by applying the usual formula for correction for the exposed part of the thermometer. The total period of heating shall not exceed 45 minutes. The residue in the flask is reported in per cent by weight."

SAMPLES TESTED.

Samples taken by inspectors from original containers during the first three months of the year were saved and a composite sample of each brand made. The analyses given were made on these composite samples.

In several instances where there was a sufficient quantity of oil for the test, only the samples for January and February were used. In several instances there was only one sample of a brand taken. This was included as it was desired to secure data on as many brands as possible.

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Number	Number of Samples Received	Name of Oil	Name of Oil Company	Flash—Elliott Cup	Baume Gravity at 60° F.	Distilling Below 250° C., Per Cent by Volume	Residue Undistilled at 300° C. (572° F.), Per Cent by Weight	From
1	23	Aladdin Security	Standard Oil Co.	106	43.1	81.0	2.4	Norfolk.
2	126	Aladdin Security	Standard Oil Co.	106	44.4	80.0	2.5	Wilmington.
3	1	Aladdin Security	Standard Oil Co.	104	43.0	78.5	2.3	Baltimore.
4	70	Aladdin Security	Standard Oil Co.	106	43.0	81.5	2.0	Richmond.
5	4	Aladdin Security	Standard Oil Co.	110	47.0	69.5	6.4	Bristol.
6	4	Diamond White	Standard Oil Co.	104	43.0	78.0	3.2	Norfolk.
7	71	Diamond White	Standard Oil Co.	106	44.3	83.0	2.5	Wilmington.
8	46	Diamond White	Standard Oil Co.	108	43.0	80.5	2.3	Richmond.
9	6	Diamond White	Standard Oil Co.	106	47.0	67.0	8.0	Bristol.
10	2	Diamond White	Standard Oil Co.	108	42.7	80.5	2.4	Baltimore.
11	3	Water White	Standard Oil Co.	106	43.0	81.0	3.1	
12	4	Carnadine	Standard Oil Co.	106	44.0	83.5	2.6	
13	127	Crystalite	The Texas Co.	116	43.7	77.0	3.4	
14	8	Headlight "A"	The Texas Co.	114	46.1	85.0	1.9	
15	4	Familylite	The Texas Co.	118	45.2	85.5	2.0	
16	2	Lone Star	The Texas Co.	116	45.8	86.0	1.7	
17	26	Red "C"	Red "C" Oil Mfg. Co.	112	47.8	78.5	2.2	
18	11	White "C"	Red "C" Oil Mfg. Co.	112	47.8	75.0	3.4	
19	7	Aurora White	Red "C" Oil Mfg. Co.	108	44.0	79.0	3.2	
20	1	Aurora Red	Red "C" Oil Mfg. Co.	114	43.5	80.5	2.8	
21	15	Water White	Cape Fear Oil Co.	122	43.6	75.5	5.2	
22	29	Water White	Indian Refining Co.	116	42.2	78.0	4.1	
23	3	Bright Kerosene	National Oil Co.	116	44.2	84.0	2.0	
24	8	White Star	National Oil Co.	118	42.5	76.0	3.9	
25	3	N. C., test White	National Oil Co.	116	43.5	80.0	3.6	
26	2	Superba White	National Oil Co.	110	47.0	80.0	3.3	
27	1	Superba Red	National Oil Co.	116	45.7	85.5	1.8	
28	8	Radium	Crown Oil & Wax Co.	114	42.3	79.0	4.1	
29	1	Soline	Crown Oil & Wax Co.	108	47.0	70.0	7.8	
30	2	Orion	Freedom Oil Works	104	46.0	76.5	4.5	
31	2	Green Seal	Freedom Oil Works	106	47.0	70.0	7.1	
32	1	"B" Burning	Sherwood Bros.	110	43.0	80.5	2.6	
33	1	Electro	Prudential Oil Co.	112	45.7	85.5	1.5	

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THE BULLETIN

OF THE

NORTH CAROLINA

DEPARTMENT OF AGRICULTURE

RALEIGH

Volume 34--No. 5. MAY, 1913. Whole No. 184.

NORTH CAROLINA DAIRY HERD RECORDS.

GOOD DAIRY HERDS AND GOOD HOMES GO HAND IN HAND

SENT FREE TO CITIZENS ON APPLICATION.

Entered at the Post-office at Raleigh, N. C., as second-class matter, February 7, 1901, under act of June 6, 1900.

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LETTER OF TRANSMITTAL.

MAJOR W. A. GRAHAM,

Commissioner of Agriculture.

SIR:—Herewith is submitted manuscript covering records of work relating to dairy herds in North Carolina, which I recommend for publication as the May Bulletin.

The Dairy Farming work was begun, in coöperation with the Bureau of Animal Industry at Washington, D. C., in 1906. Mr. W. H. Eaton, however, reports in this Bulletin only that part of the data accumuated in 1911-1912.

The work is still being carried on, and the Animal Husbandry Division is anxious to assist the dairy farmers of the State in every possible way. The Division is in position to coöperate with and assist dairymen who wish to introduce business systems of records, who wish to build dairy barns, milk houses, creameries, and silos, and all others who feel that the experience and advice of practical dairymen might help them with their dairy problems. For further information write to the Animal Husbandry Division at Raleigh, N. C., or to Mr. Alvin J. Reed, who is now in charge of the Dairy Farming phase of the live-stock work. Mr. W. H. Eaton is in charge of the Dairy Experimental work.

Respectfully,

DAN T. GRAY,
Chief in Animal Industry.

Approved for printing:
W. A. GRAHAM,
Commissioner.

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SUMMARY.

1. The data reported in this Bulletin were collected from one of the highest developed dairy sections of the State. The results shown are above the average for North Carolina dairy herds.

2. Only the most progressive dairymen can be induced to keep herd records. Unprogressive dairymen do not keep records.

3. In order to know the value of a dairy herd, it is necessary to keep a milk and butter-fat record of each cow from year to year. Such a record shows marked differences in the value of animals and serves as a guide in improving and building up the herd.

4. A large number of dairymen in North Carolina are not making a profit on a part or all of their cows.

5. This condition may be remedied by use of the milk scales and Babcock test.

6. Cows numbers 2 and 5 in herd 8 show that there is a marked difference in the cost of production of both milk and butter fat between individual cows in the same herd. Cow 2 produced milk at eight and one half cents per gallon and butter-fat at eighteen cents per pound; cow 5 produced milk at a cost of twelve and seven-tenths cents per gallon and butter-fat at twenty-three and one half cents per pound.

7. Large yielding cows were the most economical producers. Those yielding over 350 pounds of butter-fat produced it at an average cost of seventeen cents a pound and returned an average profit of $68.71. Cows yielding less than 200 pounds of butter-fat produced it at an average cost of twenty-five cents a pound and returned an average profit of $19.85.

8. The average annual cost of food for the 107 cows remaining in the herds reported in this Bulletin throughout the year was $53.03. The average total value of the products from the cows producing less than 200 pounds of butter-fat was $61.96, leaving a profit of only $8.93 or $0.75 per month.

9. Cows with records below 200 pounds of butter-fat per year can not be profitably kept on the dairy farm unless the dairyman places an abnormally high valuation on the manure and the calf.

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NORTH CAROLINA DAIRY HERD RECORDS.

By W. H. Eaton.

Purpose.

The chief purpose in presenting the yearly records given in this bulletin is to furnish the farmers and dairymen of North Carolina with information concerning the performance of individual cows. Dairymen are too often inclined to look at the production of the herds as a whole. The merits of each individual animal composing the herd should receive closer attention. It is also the purpose to show the general farmer who keeps two or three cows that herd record work is important even where only a few cows are maintained. Herds 7 and 9 contained three cows each and show the necessity of eliminating the inferior animals if the dairy industry is to be placed on its most efficient basis.

Plan.

In collecting the data given herein information on the following points was sought:

1. Annual production of milk per cow.
2. Annual production of butter-fat per cow.
3. Total annual value of products.
4. Annual cost of feed per cow.
5. Annual profit per cow.

Location of Herds.

The records of the herds reported in this bulletin represent work done in one county of the Piedmont section of the State by the Dairy Farming Division of the Department of Agriculture from September 1, 1911, through October 31, 1912, inclusive.

How the Work Was Conducted.

The dairymen were furnished regularly with daily milk and feed record sheets for recording the pounds of milk yielded by each cow, and the amount and kind of feed given. On the record was recorded the value of the butter, skim milk, the total value of the products, and the cost of feeds. Immediately after each cow was milked her product was weighed and a record of the weight placed in a column below the cow's name; this was done daily. Figure 1 shows a copy of the record sheet used.

The herds were visited once each month by a representative of the Dairy Farming Division, who tested the milk of each cow for the per cent of butter fat. Samples were taken of each cow's milk at two or more consecutive milkings. These samples were put in bottles labeled with the cow's name or number, and each sample tested with a Babcock tester for the butterfat content. The records were summarized each month to show the total amount of milk produced. The butter-fat produced was estimated by multiplying the pounds of milk produced during the month by the per cent of butter-fat. The quantity of butter produced was estimated by adding to the butter-fat one-sixth of its

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original weight. In the herd record work reported in this bulletin, the milk was accurately weighed after each milking. In most instances the feeds were weighed at irregular intervals, therefore the feed records are only close approximations.

Number and Character of Herds.

It is impossible, at present, to secure records from a sufficient number of herds to show results which will be representative for the whole of North Carolina. The majority of the herds reported in this publication are above the average in production as only the best dairymen could be induced to inaugurate and carry through the work. Record work during the year 1911-12 was inaugurated with seventy-one dairymen but only fourteen completed a year's record. The owners of decidedly inferior herds soon discontinued either from indifference or embarassment. With the exception of three or four Jersey herds mentioned in this bulletin, the majority of the cows were grade Jerseys and scrubs.

Valuation of Feeds Used.

With the exception of one herd the record work embraced in this bulletin was conduced with the patrons of a local creamery in the Piedmont section, therefore, the estimated price of feeds and dairy products is fairly uniform.

The following feeds were used during the year with the average prices per ton. All of these feeds were not, however, used upon any one farm.

Corn stover	$8.00
Mixed hay	13.00
Corn silage	3.25
Cottonseed hulls	5.80
Cottonseed	19.40
Cottonseed meal	26.25
Wheat bran	33.00
Wheat shorts	38.00
Corn chop	26.70
Sucrene	29.65
Average pasturage five months at $1.00	5.00

The price of cotton seed hulls has advanced somewhat since the fall of 1911 when most of the above feed was purchased. The wheat bran and shorts were fed in limited quantities and, being purchased in relatively small amounts, the price per ton is considerably higher than it would have been had these feeds been purchased either in ton or car lots.

The value of butter and butter-fat is based upon the actual prices for which they were sold. Skim milk was valued at forty cents per hundredweight with the exception of herd 14, the valuation of the product in this case being placed at twenty-five cents per hundredweight. Purchased feeds were valued at actual cost and home-grown feeds at the current value. It will be seen from this method of estimating the profits returned by the different herds that accurate comparisons can not be made with herds in different sections of the State, because no two dairy farmers are likely to pay the same prices for their purchased feeds. A

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fair comparison, however, can be made of the milk and butter-fat produced.

Profit or Loss.

In this bulletin profit or loss refers to the difference between the total value of the products and the total cost of the feed. No charge for feed, other than pasture and roughage, was made while the cows were dry. No charge was made for labor; it was considered that the value of manure and the calf would largely offset this item. However, this will not always hold true in the case of a scrub herd where a poor sire is used.

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Daily Milk and Feed Record for Month of _____, 191

Owner of Herd

Name of Cow																	
Daily Feed Record	1—10	11—20	21—31	1—10	11—20	21—31	1—10	11—20	21—31	1—10	11—20	21—31	1—10	11—20	21—31		
Lbs. hay @ ton																	
Lbs. silage @ ton																	
Lbs. grain @ ton																	
Lbs. grain @ ton																	
Days pasture																	

Date	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.
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29										
30										
31										
Totals										

Total, per month					
Butter-fat, per cent					
Butter-fat, lbs					
Value					
Cost of feed					
Profit					

FIG. 1.—A convenient record sheet for keeping the daily milk and feed record of each cow in the herd.

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THE RECORD TABLES.

Accompanying the following tables will be found a brief discussion of the individual herds as to the breeding, feeds, etc. No attempt has been made to discuss the rations used by the fourteen different dairymen other than to give the feeds from which the rations were composed. In many cases the purchased feeds were bought in small lots, consequently the rated price per ton is higher than it would have been had the feeds been purchased in larger quantities.

In order to show complete records for the herds as a whole, the records for the cows remaining in the herds for a few months and the records of heifers coming into milk after the work was inaugurated are given. In several cases cows were sold to give room for better ones; this information is shown in the foot notes following the tables.

TABLE NO. 1

HERD NO. I

(1911-'12)

Cow	Milk Produced Annually	Average Fat	Butter Fat	Total Value of Products	Total Cost of Feed	Profit for Year
	Pounds	*Per Cent*	*Pounds*	*Dollars*	*Dollars*	*Dollars*
1	5,635	4.6	263.70	87.63	54.08	33.55
2	6,472	5.8	376.30	137.24	60.08	77.16
3	6,513	3.7	243.90	90.19	48.30	41.89
4	4,424	5.8	257.34	93.99	43.54	50.45
5*	2,451	4.7	115.80	44.06	17.25	26.81
Average.....	5,099	4.9	251.41	90.62	44.65	45.97

*5 months record.

The cows in this herd were grade Jerseys and, as shown by the final profits, were far above the average. The herd was headed by a pure bred sire from a good producing family.

The cows had access to about ten acres of pasture for five months during the year, the early pasture was rye which had been sown the previous fall; later on in the season native grasses became available

Cream was sold during the year at 30 cents a pound on the butter-fat basis; the skimmed milk was fed to the hogs and calves and was valued at 40 sents per hundredweight.

Below are listed the feeds, together with their prices, which were used during the year:

Brewer's grain	$30.00 per ton
Cottonseed meal	26.16 per ton
Corn silage	3.00 per ton
Corn stover	8.75 per ton
Wheat bran	32.00 per ton
Cottonseed	20.00 per ton
Mixed hay	12.30 per ton
Pasture, per head	.90 per month

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TABLE NO. 2

HERD NO. II

(1911-'12)

Cow	Milk Produced Annually	Average Fat	Butter Fat	Total Value of Products	Total Cost of Feed	Profit for Year
	Pounds	*Per Cent*	*Pounds*	*Dollars*	*Dollars*	*Dollars*
1	4,121	4.8	198.1	75.33	42.21	33.12
2	4,877	4.7	231.5	88.47	47.36	41.11
3*	1,541	4.7	71.6	27.33	24.00	3.33
4	5,094	5.7	290.6	106.82	48.24	58.58
5*	3,006	6.1	184.9	65.93	29.17	36.76
6*	4,090	5.3	217.8	81.19	26.51	54.86
7†	1,695	4.6	78.3	29.95	17.57	12.38
8‡	1,058	5.8	62.3	22.74	12.16	10.58
9†	2,230	4.1	93.3	38.35	22.22	16.13
10¶	1,007	4.7	47.9	18.45	8.97	9.48
Average.....	2,872	5.1	147.6	55.46	27.84	27.62

*Sold. †8 months record; ‡7 months record; ¶3 months record.

The cows in this herd were Jersey grades. Owing to the fact that only three cows, numbers 1, 2, and 4, were in the herd the entire year the total profits for the herd are comparatively low. Cows numbers 3 and 8 were sold early in the year's work; the records soon showed them to be unprofitable; the others freshened late, ranging from four to seven months after the record work was started.

The cream was sold to a local creamery at an average price of 30 cents for each pound of butter-fat. The following feeds were used during the year; the prices quoted represent the actual farm cost:

Cottonseed meal	$26.45 per ton
Wheat bran	34.35 per ton
Sucrene	31.00 per ton
Cottonseed hulls	6.00 per ton
Corn stover	8.00 per ton
Mixed hay	13.75 per ton
Pasture, per head	1.00 per month

The cows had the run of 20 acres of native grass pasture consisting largely of crab grass and broom sedge.

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TABLE NO. 3

HERD NO. III

(1911-'12)

Cow	Milk Produced Annually	Average Fat	Butter Fat	Total Value of Products	Total Cost of Feed	Profit for Year
	Pounds	*Per Cent*	*Pounds*	*Dollars*	*Dollars*	*Dollars*
1*	2,820	4.9	140.1	52.73	35.82	16.91
2	5,429	5.1	280.6	107.63	78.08	29.55
3	4,153	5.1	211.8	79.65	68.80	10.85
4*	2,633	6.0	158.6	57.46	48.87	8.59
5	3,609	5.3	191.9	71.47	52.56	18.91
6	5,880	5.8	291.4	111.48	75.34	36.14
7	3,012	5.3	162.3	60.06	49.57	10.49
8	5,816	4.8	281.9	106.95	79.37	27.58
9†	5,042	5.8	292.6	106.76	63.17	43.59
10‡	3,342	5.3	178.0	66.00	42.46	23.54
11¶	3,396	5.3	170.5	64.43	36.02	28.41
Average.....	4,103	5.04	206.3	80.42	57.28	23.14

*Sold. †10 months record; ‡8 months record; ¶7 months record.

This herd was composed largely of grade Jerseys and grade Holstein-Friesians. One grade Holstein in this herd held the distinction during two years of being the prize winner in the two-day Production Contest at the county fair winning over some excellent cows.

With the exception of five cows this herd was low in the production of both milk and butter-fat.

In connection with five months pasturage the following feeds were used during the year:

Cottonseed meal	$26.00 per ton
Wheat bran	31.85 per ton
Sucrene	29.30 per ton
Mixed hay	15.00 per ton
Corn silage	3.50 per ton
Pasture, per head	1.00 per month

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TABLE NO. 4

HERD NO. IV

(1911-'12)

Cow	Milk Produced Annually	Average Fat	Butter Fat	Total Value of Products	Total Cost of Feed	Profit for Year
	Pounds	*Per Cent*	*Pounds*	*Dollars*	*Dollars*	*Dollars*
1	4,144	4.8	202.4	76.35	43.59	32.76
2	4,501	4.2	190.8	78.97	47.54	31.43
3	3,060	4.5	138.4	52.79	32.98	19.81
4	3,117	5.0	158.3	59.24	35.71	23.53
5	3,028	4.5	137.2	52.61	38.53	14.08
6	2,042	5.6	114.6	42.07	30.44	11.53
Average.....	3,315	4.74	156.9	60.34	38.13	22.21

This herd was composed of grade Jerseys and, as the records show, was low in the production of both milk and butter-fat. However, the cows were carefully fed by their owner, hence each one made a small margin of profit. Cow number 6, however, shows a profit of less than one dollar per month, which is very low. The total value of the products from this herd for the year, not including the manure or calves, was $362.06. The entire cost of feed for the year was $228.79, leaving a total profit of $133.24 or $22.20 per cow. Cow number 6 made only one-half as great a yearly profit as the whole herd averaged.

During the summer months the cows grazed on twenty acres of ordinary pasture of native grasses.

The following feeds were used during the year:

Cottonseed meal	$26.17 per ton
Wheat bran	32.35 per ton
Cottonseed hulls	5.65 per ton
Soiling crops	4.00 per ton
Mixed hay	11.50 per ton
Corn stover	8.00 per ton

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TABLE NO. 5

HERD NO. V

(1911-'12)

Cow	Milk Produced Annually	Average Fat	Butter Fat	Total Value of Products	Total Cost of Feed	Profit for Year
	Pounds	*Per Cent*	*Pounds*	*Dollars*	*Dollars*	*Dollars*
1*	2,005	5.0	100.7	37.82	16.54	21.28
2	4,251	5.5	236.8	87.07	44.61	42.46
3	3,960	5.8	229.7	83.81	50.82	32.99
4	3,874	5.6	217.4	79.83	47.83	32.00
5	4,852	4.7	231.3	86.55	47.16	39.39
6	4,197	6.0	252.8	91.56	51.40	40.16
7	3,379	5.4	183.1	65.25	38.37	26.88
8*	439	5.1	22.8	8.51	4.10	4.41
9	3,064	6.1	188.6	68.06	42.02	26.04
10	2,660	4.2	112.2	43.59	36.37	7.22
11*	483	7.0	35.5	12.41	11.54	0.87
12	2,917	5.7	167.2	60.91	37.47	23.44
13	3,384	5.6	196.9	72.16	40.93	31.23
14†	1,381	5.4	75.5	27.87	13.71	14.16
15*	270	5.1	14.0	5.23	4.18	1.05
16†	1,092	4.1	45.5	17.93	9.14	8.79
17†	510	5.0	25.5	9.58	5.18	4.40
18†	757	5.8	44.5	16.19	7.83	8.36
Average.....	2,416	5.5	132.2	48.57	28.29	20.28

*Sold. †Heifer.

This herd was composed of pure bred Jerseys, with the exception of one cow, a Jersey-Holstein cross. The herd was headed by an excellent sire, Ora's Sultan No. 79165 whose dam's record for butter production was 689 pounds; his grand dam's record was 654 pounds of butter in one year.

The owner of this herd has a definite purpose in view and has been keeping herd records and eliminating the low producers and boarders from the herd for several years. The herd was carefully fed and managed. One reason for the moderately low production of the herd as a whole was due to the fact that it was composed largely of heifers with their first or second calf. The herd strongly indicates that it will increase in annual production as soon as the cows have reached maturity.

In connection with five months pasturage on twenty acres of natural grasses the cows were fed the following feeds:

Cottonseed meal	$25.35 per ton
Wheat bran	29.00 per ton
Sucrene	29.30 per ton
Mixed hay	16.50 per ton
Cottonseed	20.00 per ton
Corn stover	8.00 per ton
Soiling crops	4.00 per ton
Corn silage	3.00 per ton

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TABLE NO. 6

HERD NO. VI

(1911-'12)

Cow	Milk Produced Annually	Average Fat	Butter Fat	Total Value of Products	Total Cost of Feed	Profit for Year
	Pounds	*Per Cent*	*Pounds*	*Dollars*	*Dollars*	*Dollars*
1	4,679	4.6	219.8	84.16	50.37	33.79
2	5,423	5.2	285.2	103.19	48.98	54.31
3	5,886	4.6	270.7	99.91	51.97	47.94
4	4,083	5.2	213.8	80.24	42.19	38.05
5	5,500	5.5	291.6	108.63	46.89	61.74
6	4,370	4.5	200.2	77.66	48.73	28.93
7	5,346	5.4	290.6	107.67	50.20	57.47
8*	2,996	4.9	148.6	56.29	23.11	33.18
Average.....	4,785	5.04	240.1	89.72	45.30	44.42

*7 months record.

This herd was composed of high-grade Jerseys and was headed by a pure bred Jersey sire whose dam's record was 350 pounds of butter. This farmer had a definite idea in view—that of raising the standard of the production of his herd. The owner of this herd has appreciated for some time the value of the milk scales and record sheets on his farm, and has been giving his personal care to the selection and breeding of his herd.

In addition to five months pasturage on a good Bermuda and Lespedeza pasture, the cows were fed the following feeds at the following average prices:

Cottonseed meal	$26.50 per ton
Wheat bran	33.75 per ton
Cottonseed	17.33 per ton
Corn silage	3.50 per ton
Mixed hay	13.30 per ton
Corn stover	8.00 per ton

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TABLE NO. 7

HERD NO. VII

(1911-'12)

Cow	Milk Produced Annually	Average Fat	Butter Fat	Total Value of Products	Total Cost of Feed	Profit for Year
	Pounds	*Per Cent*	*Pounds*	*Dollars*	*Dollars*	*Dollars*
1	2,474	6.2	155.3	55.75	30.13	25.62
2	3,673	7.4	273.3	96.40	37.92	58.48
3	3,848	7.2	278.8	98.72	37.92	60.80
Average.....	3,332	7.1	235.8	83.62	35.32	48.30

As a side line to the general farm work three cows were kept on this farm. The cows were grade Jerseys and, as their records show, were above the average in production.

Cow number 1 returned a clear profit of $2.00 per month, while number 2 and 3 returned a net profit of practically $5.00 per month.

In this herd we find a practical demonstration of the real worth of record work with the small herd. It actually required less than five minutes of time each day to weigh and record the milk produced on the farm and this, with a few minutes work each month, making the Babcock test and summarizing the records, embraced the entire time required for the work throughout the year. Cow number 2, with only $8.00 more feed, gave her owner $32.86 more profit than cow number 1; cow number 3, with an additional $8.00 worth of feed, gave $35.18 more profit than cow number 1.

In connection with ten acres of meadow pasture for five months the cows had the following feeds at the prices per ton given below:

Cottonseed meal	$26.00 per ton
Cottonseed	19.85 per ton
Wheat bran	35.00 per ton
Shorts	38.00 per ton
Sucrene	31.00 per ton
Mixed hay	8.00 per ton
Corn stover	8.00 per ton

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TABLE NO. 8

HERD NO. VIII

(1911-'12)

Cow	Milk Produced Annually	Average Fat	Butter Fat	Total Value of Products	Total Cost of Feed	Profit for Year
	Pounds	*Per Cent*	*Pounds*	*Dollars*	*Dollars*	*Dollars*
1*	2,649	5.5	146.2	53.50	37.58	15.92
2	6,877	5.5	380.6	139.77	68.76	71.01
3	4,360	5.3	232.3	85.85	53.89	31.96
4	5,492	5.9	328.6	118.80	61.87	56.93
5	3,282	6.3	206.9	74.07	48.74	25.33
6*	1,389	6.4	90.1	32.00	31.23	.77
7	6,394	5.7	368.8	134.47	63.70	70.77
8	4,017	6.0	241.8	87.21	51.99	35.22
9*	853	5.5	47.2	17.39	12.16	5.23
10*	1,843	5.1	94.2	34.43	24.49	9.94
11	1,344	6.4	86.8	31.07	21.40	9.67
12	4,745	5.8	277.3	100.49	52.84	47.65
Average.....	3,604	5.8	208.4	75.75	44.05	31.70

*Sold.

At the beginning of the year's work, this herd was composed of five grade Jerseys and seven pure breds but before the year's work was completed four of the grade cows were sold. The herd was headed by an excellent dairy sire whose dam's record for one year was a little less than 700 pounds of butter. The owner of this herd has had a definite abject in view for some years—that of grading up the herd and increasing the milk flow and butter-fat production. Cow number 2 in this herd has the distinction of ranking as one of the highest producers in her section.

During the months of April and May the cows were allowed to run on seven acres of rye and crimson clover; during July, August and September they were pastured on fifteen acres of native grasses.

The following are the feeds used on this farm during the year:

Cottonseed meal	$25.50 per ton
Sucrene	29.30 per ton
Soiling crops	4.00 per ton
Corn silage	4.00 per ton
Corn stover	8.00 per ton

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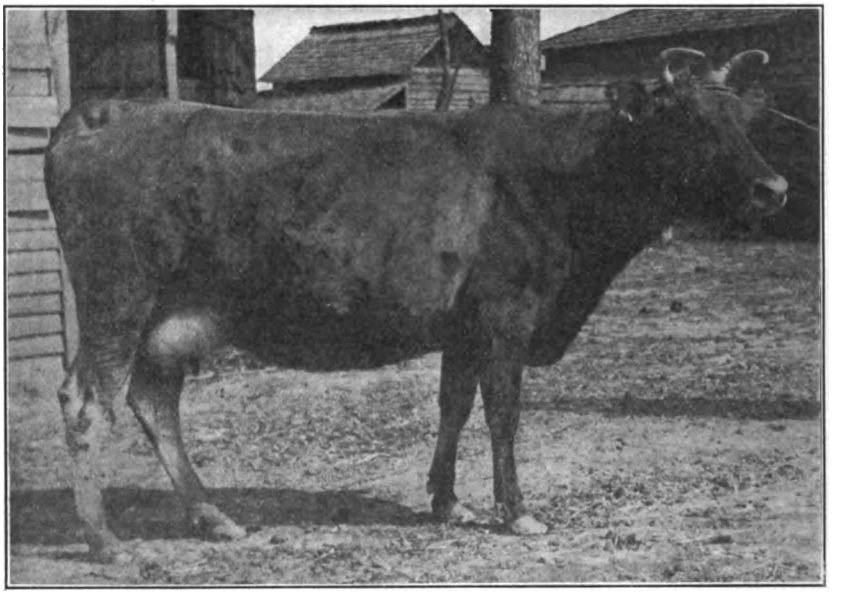

Cow No. 2, Herd No. 8.

This cow shows a very good dairy type; she has an excellent top line with the tendency, perhaps, towards a trifle coarseness over the withers. The depth through the body and the spring of ribs indicate good feeding capacity. The depth through the heart girth and the width of muzzle indicate a strong, vigorous constitution. When in milk she showed a good udder, attached well up behind and carried well forward. This cow holds fourth place in milk production with the cows reported in this bulletin.

Her year's record:

Pounds milk	6,877
Gallons milk	799.6
Pounds butter-fat	380.6
Average test, per cent	5.5
Pounds estimated butter	444
Total value products	$139.77
Cost of feed	68.76
Profit	71.01
Cost of producing one pound of butter-fat	0.18
Cost of producing one gallon of milk	0.085

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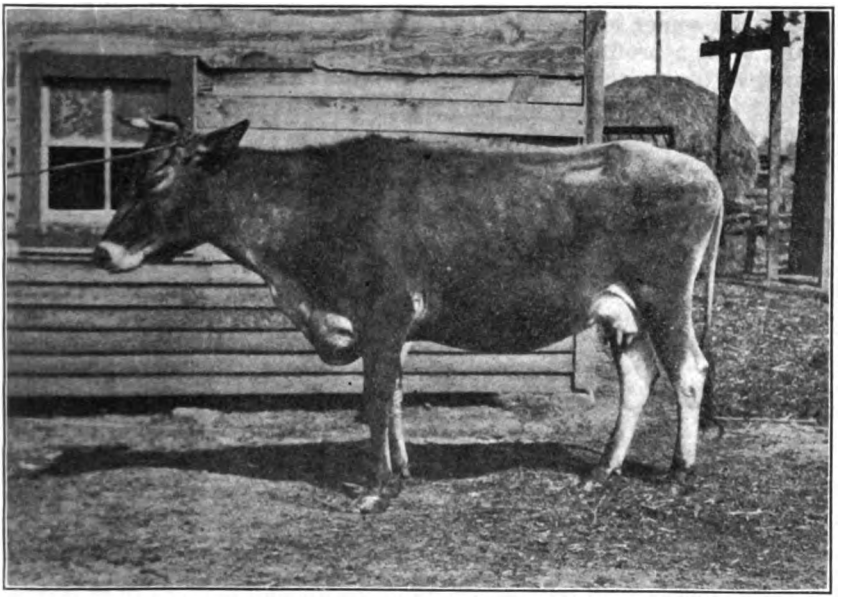

COW NO. 5, HERD NO. 8.

This cow shows a very poor dairy type and her record for the year is better than could be expected. Her top line is poor, showing a drooping rump. She is lacking in both depth of body and spring of ribs, hence has a limited capacity for handling feed. The shallowness through her heart girth, and the narrow, funnel-shaped muzzle indicate a lack of constitution and vigor.

Her year's record:

Pounds milk	3,282
Gallons milk	381.6
Pounds butter-fat	206.9
Average test, per cent	6.3
Pounds estimated butter	248.3
Total value of products	$74.07
Cost of feed	48.74
Profit	25.33
Cost of producing one pound of butter-fat	0.235
Cost of producing one gallon of milk	0.127

A study of the records of these two cows reveals the importance of record keeping on the dairy farm. It will be noticed that both cows were kept at a profit; cow number 2 returned an average profit of $5.91 per month while cow number 5 returned only $2.11 for the same period of time. Cow number 2 gave an increase of 418 gallons of milk and 173.7 pounds of butter-fat over cow number 5, and she also charged her owner five and one-half cents less for producing each pound of butter-

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fat, and four and two-tenths cents less for producing each gallon of milk during the year. Cream was sold from this farm at an average price of thirty cents for each pound of butter-fat. Cow number 2 charged her owner eighteen cents per pound for producing this butter-fat and made a profit of twelve cents on each pound sold. Cow number 5 charged twenty-three and one-half cents for producing an equal amount of butter-fat, leaving only a profit of six and four-tenths cents on each pound sold.

TABLE NO. 9

HERD NO. IX

(1911-'12)

Cow	Milk Produced Annually	Average Fat	Butter Fat	Total Value of Products	Total Cost of Feed	Profit for Year
	Pounds	*Per Cent*	*Pounds*	*Dollars*	*Dollars*	*Dollars*
1	4,213	6.0	256.8	92.82	53.45	39.37
2	3,367	5.8	198.2	71.58	53.53	18.05
3	6,587	5.3	351.4	129.32	62.71	66.61
Average.....	4,733	5.7	268.8	97.91	56.56	41.34

As was the case with herd number 7, the cows on this farm were kept as a side line to the general farm work. Cream was sold to the local creamery at an average price of thirty cents for each pound of butter-fat. The skim milk was fed to the calves and hogs at a feeding value of forty cents per hundredweight.

The cows were grade Jerseys and, with the exception of number 2, were above the average in production. At the conclusion of the year's work, the owner of this herd found from a summary of his records that cow number 3 made $9.19 more profit than the combined profits of numbers 1 and 2.

By dividing the cost of the feed for the year by the number of pounds of butter-fat produced, it will be found that cow number 1 charged 0.208 cents for producing each pound of butter-fat, number 2 charged 0.27 cents and number 3 charged 0.178. In cheapness of production as well as in the amount of butter-fat and milk, number 1 was by far the best cow in the herd.

In connection with five months of pasture the following feeds were used during the year:

Cottonseed	$20.00 per ton
Wheat bran	34.25 per ton
Cottonseed meal	25.00 per ton
Mixed hay	10.00 per ton
Corn stover	8.00 per ton

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TABLE NO. 10

HERD NO. X

(1911-'12)

Cow	Milk Produced Annually	Average Fat	Butter Fat	Total Value of Products	Total Cost of Feed	Profit for Year
	Pounds	*Per Cent*	*Pounds*	*Dollars*	*Dollars*	*Dollars*
1	4,746	5.8	275.9	100.76	50.67	50.09
2	5,973	4.6	270.3	103.58	59.09	44.49
3	3,780	4.9	185.7	69.66	55.49	14.17
4	5,339	4.8	258.6	97.90	61.41	36.49
5	3,376	5.4	185.4	68.14	44.73	23.41
6	5,252	6.0	315.6	113.43	53.79	59.64
7	4,179	4.8	201.9	76.09	53.66	22.43
8	3,033	6.2	189.0	68.01	49.17	18.84
9*	2,953	4.4	130.8	51.84	20.28	31.56
Average.....	4,296	5.2	223.8	81.47	46.80	34.67

*5 months record.

The cows comprising this herd were all grade Jerseys and, as the records show, some were very low producers. The herd was headed by an excellent dairy sire whose dam's record at the age of 17 years was 660 pounds of butter. This owner realized some time ago that the money spent for this sire was by far one of the best investments on his farm. The offspring from this sire show constitution, dairy temperament, and excellent dairy form. It is to be expected, when these heifers come into milk, that they will excel the records of their dams.

Cream was sold to the local creamery at an average of about thirty cents for each pound of butter-fat and the skim milk was used for feeding purposes at a feeding value of forty cents per hundredweight.

In connection with five acres of Herd's Grass, and forty-five acres of broom sedge and Lespedeza pasture, the following feeds were used:

Cottonseed meal	$28.00 per ton
Cottonseed	20.00 per ton
Wheat bran	34.55 per ton
Corn chop	26.70 per ton
Sucrene	31.00 per ton
Mixed hay	10.75 per ton
Corn stover	8.00 per ton

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TABLE NO. 11

HERD NO. XI

(1911-'12)

Cow	Milk Produced Annually	Average Fat	Butter Fat	Total Value of Products	Total Cost of Feed	Profit for Year
	Pounds	*Per Cent*	*Pounds*	*Dollars*	*Dollars*	*Dollars*
1	4,314	5.4	234.8	86.36	44.21	42.15
2*	2,690	5.1	137.8	54.39	25.15	29.24
3	6,824	4.1	284.1	111.23	56.63	54.60
4	4,884	5.7	281.0	102.85	51.69	51.16
5	4,364	5.2	227.6	84.88	44.58	40.30
6*	762	8.0	61.2	20.93	19.41	1.52
7	4,668	6.0	280.9	101.81	51.83	49.98
8	3,339	4.7	157.8	60.09	41.24	18.85
9	4,158	5.3	223.1	80.86	47.33	33.53
10	3,830	6.0	231.4	83.71	41.34	42.37
11†	1,690	4.6	78.7	30.41	20.64	9.77
12†	2,958	5.7	171.3	62.84	26.59	36.25
13†	2,794	5.1	144.2	53.96	29.37	24.59
14*	1,796	5.9	106.5	38.60	15.89	22.71
Average.....	3,505	6.8	237.1	89.49	36.85	32.64

*Sold. †Heifer.

This farm, perhaps, holds the distinction of having purchased the first Jersey cow that was brought into that section of the State. For several years the owner bred only pure Jerseys, but later on introduced some Holstein-Friesian blood. This infusion of blood was an attempt to couple the milk flow of the Holstein-Friesian with the richness of the Jersey milk. After several years of work with this object in view, the owner of the herd realized that he was not making progress and abandoned the idea.

During 1911-12 the herd was composed of three pure bred Jerseys and eleven grades. The herd was headed by an excellent pure bred Jersey sire whose dam's record in butter production for one year was only 10.5 pounds short of the 700 pound mark.

In connection with twenty acres of Bermuda and twenty acres of Lespedeza and native grass pastures for six months, the following feeds were used during the year:

Cottonseed meal	$26.16 per ton
Cottonseed	18.00 per ton
Sucrene	28.00 per ton
Sorghum hay	5.00 per ton
Mixed hay	12.00 per ton
Corn silage	2.50 per ton
Corn stover	8.00 per ton

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TABLE NO. 12

HERD NO. XII

(1911-'12)

Cow	Milk Produced Annually	Average Fat	Butter Fat	Total Value of Products	Total Cost of Feed	Profit for Year
	Pounds	*Per Cent*	*Pounds*	*Dollars*	*Dollars*	*Dollars*
1*	411	5.9	24.3	8.73	12.91	4.18
2	4,275	4.9	212.3	79.96	42.57	37.39
3	4,228	5.1	218.0	87.46	50.09	31.37
4	5,072	6.2	317.1	113.73	50.90	62.83
5	3,585	5.4	194.4	71.51	35.94	35.57
6	4,447	6.3	283.1	102.87	44.24	58.63
7	4,923	6.0	297.8	106.13	42.83	63.30
8	4,958	5.5	274.1	100.94	44.95	55.99
Average.....	3,987	5.9	227.6	83.91	40.55	43.36

*Sold.

This herd was composed of seven grade Jerseys and one pure bred. The herd was headed by Golden Lad of Fair View, a promising young sire whose dam's record was 486 pounds of estimated butter. The owner of this herd was an enthusiastic young farmer who appreciated the fact that good dairy blood, the use of the milk scales and tester combined, with careful herd management, would place him on the right road to success in dairy farming.

Cows numbers 4, 6 and 7 showed an excellent margin of profit over the cost of their feed bill for the year. Cow number 1, after being in the herd for five months at a net loss of $4.81, was sold. Cows like this one if kept in any herd will seriously interfere with the net profits from the good cows.

The cows had the run of 15 acres of pasture—three acres of Lespedeza and 12 acres of broom sedge and Lespedeza. Owing to the severe drouth the pasture was short and, in consequence, the cows had only about three months of grazing during the year.

The following feeds were used during the year:

Cottonseed meal	$25.00 per ton
Cotton seed	20.00 per ton
Wheat bran	32.00 per ton
Cottonseed hulls	5.75 per ton
Mixed hay	15.00 per ton
Soiling crops	3.00 per ton

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TABLE NO. 13

HERD NO. XIII

(1911-'12)

Cow	Milk Produced Annually	Average Fat	Butter Fat	Total Value of Products	Total Cost of Feed	Profit for Year
	Pounds	*Per Cent*	*Pounds*	*Dollars*	*Dollars*	*Dollars*
1*	3,051	5.7	173.77	63.64	31.97	31.67
2	4,503	5.5	248.47	89.49	57.92	31.57
3	5,269	5.7	302.08	110.42	55.43	54.99
4	4,363	5.9	258.02	103.79	55.43	48.36
5	5,895	5.5	324.85	119.62	55.43	64.19
6*	2,057	5.3	108.88	40.45	32.99	7.46
7	4,755	4.9	232.70	87.84	60.59	27.25
8	5,142	5.2	271.13	100.76	55.30	45.46
9†	2,184	5.3	115.61	42.95	19.89	23.06
Average.....	4,135	5.4	226.17	84.33	47.22	37.11

*Sold. †Heifer, 5 months record.

This herd was composed largely of high-grade Jerseys, and as their records indicate, were animals of considerable merit. The owner of this herd had been eliminating the low producers for four years, his object being to bring the average yearly production up to at least 5,000 pounds of milk.

An excellent pure bred sire from a high producing family was at the head of this herd; none of his progeny were in milk at the time the record work was conducted, but they were a promising lot of heifers and showed more capacity than their dams.

The cows had the run of a small field of crimson clover and about twenty acres of native grasses. The ration was composed of the following concentrates and roughages:

Cottonseed meal	$26.15 per ton
Cottonseed	18.66 per ton
Sucrene	29.72 per ton
Wheat bran	31.66 per ton
Corn silage	3.35 per ton
Soiling crops	4.00 per ton
Corn stover	6.00 per ton
Mixed hay	15.00 per ton

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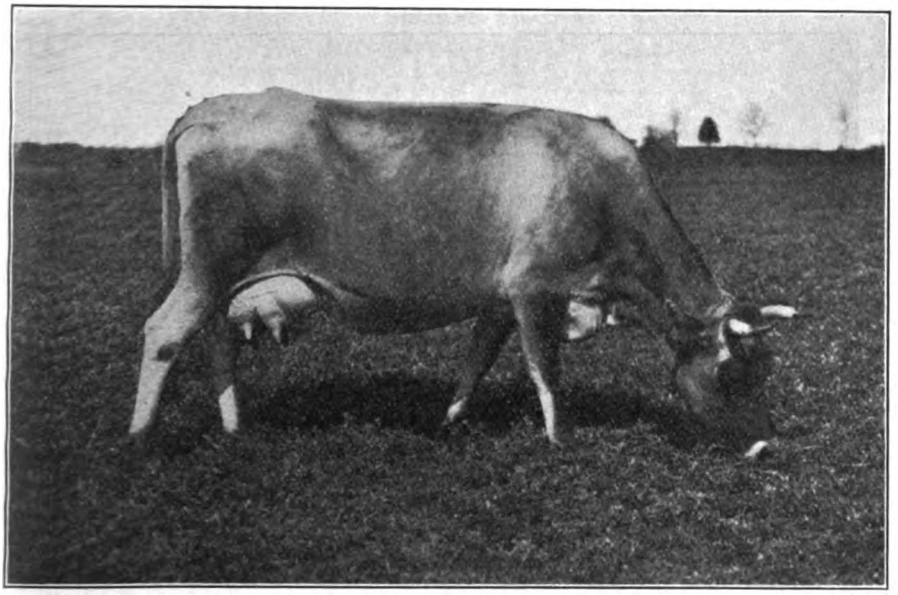

Cow No. 25, Herd No. 14.

This cow is the second highest producer in the herd. In dairy form she is an ideal to have in mind in breeding and selecting the herd. Note the good udder, prominent milk veins and capacity for handling feed. Her average annual profit for three years was $58.74.

The average for the cows in this herd for three years was 5,106 pounds of milk, 272.8 pounds butter-fat, (making 318.7 pounds of estimated butter) with an average annual profit per cow of $40.67. The cow shown above yielded an average of 5,642 pounds milk, 337.6 pounds of butter-fat, 393.8 pounds of estimated butter, with an average annual profit of $58.74.

There are very few cows of this character in the State, so it impossible for every one, or even a large proportion of North Carolina farmers and dairymen, to dispose of the animals they are now milking and fill their places with the more desirable type. There is a practical method, however, of replacing the common cows with good individuals; it can be done by selection and breeding.

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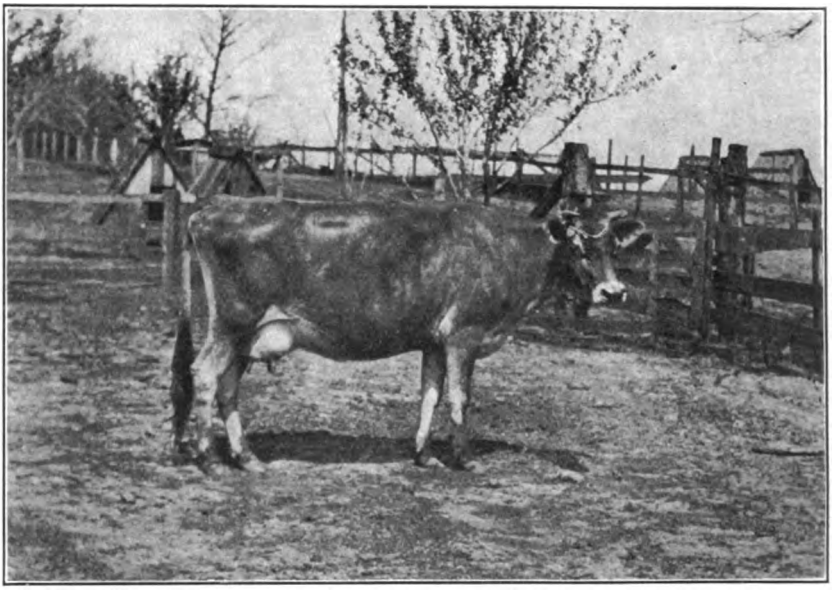

A COW IN HERD No. 14.

Typical Island type. An excellent top line, head, and udder. Note narrowness between horns, width between eyes, dished face, heavy muscles under jaw and width of muzzle. These points are insisted on by Island breeders. In connection with conformation, the cow is a good producer. Her record for 1912 was 5296.5 pounds of milk and 349 pounds butter.

Her year's record:

Pounds milk	5,296.5
Pounds butter-fat	299.22
Pounds estimated butter	349.09
Value of products	$109.23
Cost of feed	65.51
Profit	43.72

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TABLE NO. 14

HERD NO. XIV

AVERAGE RECORDS 1910-'11-'12

Cow	Milk Produced Annually	Average Fat	Butter Fat	Estimated Butter	Total Value Products	Total Cost of Feed	Profit For Year
	Pounds	*Per Cent*	*Pounds*	*Pounds*	*Dollars*	*Dollars*	*Dollars*
1	5,243	5.2	275.9	345.2	111.79	65.32	46.46
2	5,509	5.2	290.4	338.9	106.93	63.47	43.46
3	5,438	4.8	264.6	308.8	100.84	63.94	36.89
4	3,852	5.6	218.7	255.2	82.48	50.88	31.93
5	5,168	5.2	270.0	315.0	98.59	63.62	40.78
6	5,038	6.3	324.9	379.1	117.88	63.15	54.73
7	4,938	5.1	252.2	294.1	98.18	58.61	39.57
8	4,460	6.3	284.6	332.1	107.44	63.86	43.61
9	4,868	5.4	265.5	309.7	99.13	65.85	39.94
10	5,418	5.9	269.3	314.2	102.30	66.72	35.58
11	4,691	5.9	278.4	324.8	101.60	65.98	33.61
12	5,327	5.5	293.3	342.2	112.81	63.76	49.05
13	3,414	5.6	194.5	226.9	70.87	52.47	18.40
14	4,105	5.1	210.8	245.9	76.39	53.84	22.55
15	5,318	5.5	293.9	342.8	109.96	64.30	45.66
16	5,340	5.6	299.3	349.2	112.17	70.49	41.68
17	7,523	5.2	392.4	457.8	153.22	76.62	76.60
18	5,562	5.6	314.9	367.5	116.19	66.02	50.16
19	6,024	5.2	316.0	369.5	117.55	68.23	49.23
20	5,144	5.4	280.0	326.7	101.92	68.22	33.70
21	6,445	5.0	324.0	378.0	122.25	67.13	48.45
22	5,085	5.3	271.4	316.7	101.50	59.76	41.74
23	5,089	5.4	276.2	322.2	104.07	62.00	42.01
24	5,963	5.2	312.1	368.0	117.71	67.90	49.81
25	5,642	5.9	337.6	393.8	126.43	67.68	58.74
26	3,744	5.7	213.4	249.4	79.50	54.90	24.59
27	4,708	4.7	222.0	259.3	83.61	61.46	22.15
28	3,116	5.2	162.5	189.0	61.06	48.20	12.86
Average.....	5,106	5.3	272.8	318.7	101.08	63.32	40.67

During 1911-12 this herd was composed of about 50 pure bred Jerseys in milk. Prior to 1911 seventeen of these cows had entered the Register of Merit, their average being 449.64 pounds of butter. During 1912 twelve more cows in this herd qualified for the Register of Merit. This herd has the distinction of having one of the oldest cows in the Register of Merit, she being in her seventeenth year when the test was completed.

Out of this herd were selected 28 cows having complete records for three years. Butter was sold from this farm during the three years of the record work at an average price of thirty cents per pound. Skim milk was fed to the calves and hogs at a feeding value of twenty-five cents per hundredweight.

The production of the cows in this herd for 1910, 1911 and 1912 was remarkably uniform there being a variation of only a few pounds in butter-fat production during the three years.

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The owner of this herd had been a close student of dairy problems for eighteen or twenty years, and had been following a rigorous system of selection. Three sires are in service in this herd, Eminent's Flying Fox, imported, Sensational Fern 4th, and Honeymoon's Fairy Boy.

In connection with five month's pasturage on native grasses, the cows had the following feeds:

Cottonseed meal	$28.00 per ton
Wheat bran	34.00 per ton
Sucrene	28.00 per ton
Mixed hay	15.00 per ton
Corn silage	3.00 per ton
Soiling crops	4.00 per ton

TABLE NO. 15

RECORDS OF COWS PRODUCING 350 OR MORE POUNDS OF BUTTER FAT YEARLY

Number Herd	Number Cow	Pounds Butter Fat	Value Products	Cost of Feed
XIV—'12	17	429.7	$ 160.79	$ 71.54
XIV—'12	18	398.0	147.80	67.85
XIV—'12	25	358.0	130.86	67.15
XIV—'10	17	375.8	149.44	79.16
XIV—'10	25	351.6	141.18	66.12
XIV—'11	2	353.4	122.36	77.11
XIV—'11	19	350.3	120.43	75.73
I	2	376.3	137.24	60.08
VIII	2	380.6	139.77	68.76
VIII	7	368.8	134.47	63.70
Average		374.05	138.43	69.72

Average food cost per pound of butter fat ..... $ 0.17

Average profit per cow 68.71

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TABLE NO. 17

COWS PRODUCING LESS THAN 200 POUNDS BUTTER FAT YEARLY

Number Herd	Number Cow	Butter Fat	Total Value	Cost of Feed
II	1	198.1	$ 75.33	$ 42.21
III	5	191.9	71.47	48.87
III	7	162.3	60.06	49.57
IV	2	190.8	78.97	47.54
IV	3	138.4	52.79	32.98
IV	4	158.3	59.24	35.71
IV	5	137.2	52.61	38.53
IV	6	114.6	42.07	30.44
V	1	100.7	37.82	16.54
V	9	188.6	68.06	42.02
V	10	122.2	43.59	36.37
V	12	167.2	60.91	37.47
V	13	196.9	72.16	40.93
VII	1	155.3	55.75	30.13
IX1	2	198.2	71.58	53.55
X	3	185.7	69.66	55.49
X	5	185.4	68.14	44.73
X	8	189.8	68.01	49.17
XII	8	157.8	60.09	41.24
XII	5	194.4	71.51	35.94
XIV—1910	26	155.3	59.34	47.03
XIV—1910	28	96.2	39.32	38.18
XIV—1912	13	192.4	73.57	54.99
XIV—1912	27	166.2	61.80	53.51
XIV—1912	28	184.3	68.60	49.73
Average		165.12	61.98	42.11

Average cost per pound of butter fat ..... $ 0.25
Average profit per cow 19.85

LARGE PRODUCERS MOST ECONOMICAL.

The question is frequently discussed as to the influence of large and small yielding cows upon the cost of production. The point is often made that, with large yields the increase in the cost of food overbalances the profit. In order to answer the question of economcial yield between cows of large and small productive capacity Tables 15 and 16 have been prepared. In the former the data for cows producing 350 or more pounds of fat are given. Out of the 144 cows reported in this bulletin there are 10 such cows. Their average yield is 374.05 pounds of butter-fat. Valuing butter-fat at thirty cents a pound and skim milk at forty cents per hundredweight, the average total value of the products per cow was $138.43. The average annual cost of food per cow was $69.73. The average expense to make each pound of butter-fat was $0.17. The average annual profit per cow was $69.71.

In Table number 16 are shown the records of the cows producing less than 200 pounds of butter-fat. There were 25 such cows remaining

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in the herds throughout the year. Their average yield was 165.12 pounds of butter-fat. The average total value of products per cow was $61.96. The average annual cost of food per cow was $42.11. The average cost to make each pound of butter-fat was $0.25. The average annual profit per cow was $19.85.

According to these results the large producers yielded butter-fat at an average expense of eight cents a pound less than did the low producers. It should also be noted that the high producing cows returned an average profit of $68.71 each, while each of the low producing animals can be credited with a yearly profit of only $19.85. If it were not for the fact that dairy products sell for an abnormally high price in the South the great majority of our dairy cows would be kept at a large financial loss.

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LEAF TOBACCO SALES FOR APRIL, 1913.

Pounds sold for producers, first hand	136,961
Pounds sold for dealers	19,736
Pounds sold for warehouses	7,570
Total	164,267

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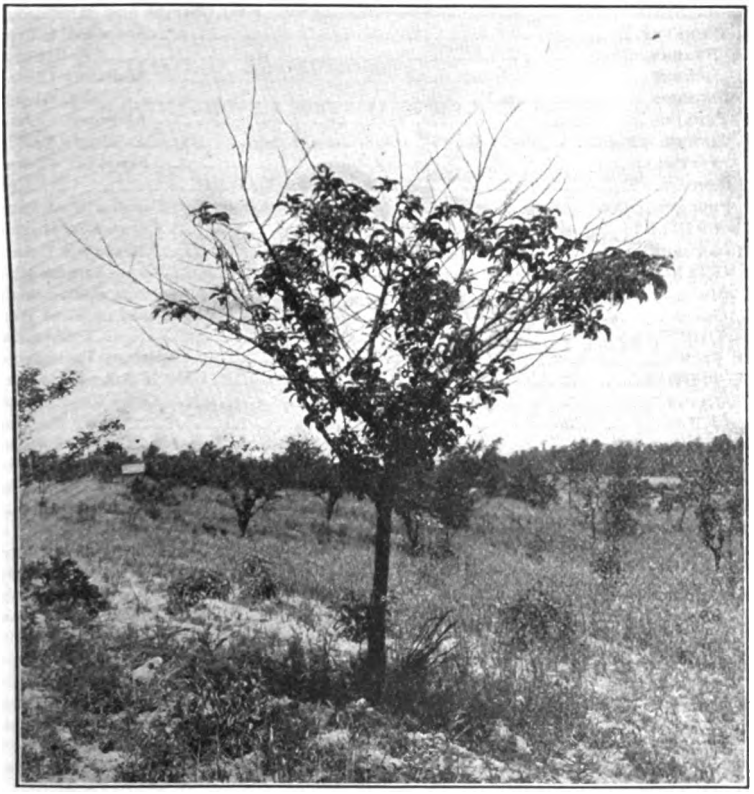
THE BULLETIN
OF THE
NORTH CAROLINA
DEPARTMENT OF AGRICULTURE
RALEIGH

Vol. 34, No. 6. JUNE, 1913. Whole No. 185.

THE OYSTER-SHELL SCALE

(Recommendation of Remedies on page *18.*)



APPLE TREE DYING FROM OYSTER-SHELL SCALE, SURRY COUNTY, N. C.
Photo by Z. P. Metcalf.

PUBLISHED MONTHLY AND SENT FREE TO CITIZENS ON APPLICATION.
Entered at the Post-office at Raleigh, N. C., as second-class matter,
February 7, 1901, under Act of June 6, 1900.

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LETTER OF TRANSMITTAL

MAJ. W. A. GRAHAM, *Commissioner.*

SIR:—I submit herewith manuscript for a BULLETIN on "The Oyster-shell Scale." Next to the San José Scale, this is the most important scale-insect in the apple orchards of North Carolina, and the very considerable number of complaints and inquiries which we receive regarding it each year warrants the publication of a bulletin on the subject.

I recommend its publication as the June BULLETIN for 1913.

Very respectfully,

FRANKLIN SHERMAN, JR.,
Entomologist.

Approved for printing,
W. A. GRAHAM, *Commissioner.*

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SUMMARY OF IMPORTANT POINTS REGARDING OYSTER-SHELL SCALE

1. The Oyster-shell Scale is complained of frequently by North Carolina fruit-growers, and its importance as a pest in the State is due to its attacks on the apple, though it may attack a wide variety of other plants (p. 5).
2. Growers who spray regularly for the San José Scale are not seriously troubled by it, because the treatments control it (p. 5).
3. The severity of damage by it varies from almost no damage to the killing of individual trees, or in exceptional cases the entire orchard may be killed (p. 8-10).
4. It is very prevalent throughout all the mountainous section of the State, and through the upper Piedmont or "foot-hill" region, and is also recorded in several scattered localities as far eastward as the counties of Mecklenburg, Stanly, Rowan, Davidson, Chatham, Wake, and Granville, and it is believed that on an average it is more severe in the more eastern localities than in the mountainous parts of the State (p. 10).
5. The winter is passed in the egg stage under the scale of the parent female—the eggs hatch most numerously in April, and a spraying to kill the young would be most effectively applied in the latter part of April or early May (p. 13).
6. Natural enemies aid to some extent in controlling it, parasites and predaceous enemies (in cases examined) having killed nearly 14 per cent during the winter (p. 15-17).
7. (a) As to remedies, first choice is given to soluble oils at rate of 1 gal. to 8 or 10 gals. water, applied in late winter before the buds open (p. 18).
   (b) Second choice is kerosene emulsion at 25 per cent oil, applied in late winter before buds open (p. 18).
   (c) Third choice is the lime-sulphur washes, either the commercial ready-made ones, or the home-made wash applied in late winter before buds open (p. 18).
   (d) In case the winter treatment can not be given one may use kerosene emulsion at 15 per cent oil, applied in late April or early May (p. 18).
8. It is desirable that any dead or useless branches be cut out before spraying to control the Oyster-shell Scale.

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THE OYSTER-SHELL SCALE

Lepidosaphes ulmi, L.

By FRANKLIN SHERMAN, JR., *Entomologist.*

Order *Hemiptera.* Family *Coccidæ.*

Introductory. The apple-growers of North Carolina complain more often about the Oyster-shell Scale than they do of any other scale-insect attacking their trees—with the exception of the San José Scale, which still overshadows all others combined. It seldom kills the trees outright and therefore is not noticed so quickly as it deserves, and even when trees are killed by it the grower usually never knows the real cause. Hence the frequency of complaint of the Oyster-shell Scale is not fully commensurate with the damage which it does. Probably the greatest harm comes not so much from the few trees that are actually killed, but from the general weakening and greater or less stunting effect on the new growth of trees, which live on indefinitely but never attain the full measure of health and productiveness that they would if this scale were not present.

It is primarily a pest of the apple tree, though many other kinds of trees are more or less infested by it. It is not known to be present in destructive numbers east of Raleigh, so a large part of the State is seemingly (for the present at least) free from injury by it. To the westward from Raleigh it is serious in scattered localities throughout the middle section, and in the mountains it seems to be present in apple orchards everywhere, though not often actually killing the trees.

The most advanced growers, who give their trees spraying treatment every year with sulphur or oil sprays as a precaution against San José Scale and fungous diseases, appear to suffer but little from this Oyster-shell Scale, because the strengths of these sulphur and oil sprays which are used are sufficient to control this pest. But in small farm orchards where no regular spraying is done this scale has free chance to multiply, except for the natural enemies which prey upon it. For this reason some knowledge of these natural enemies of the Oyster-shell Scale is of interest and importance, and in this account some attention is given to this feature.

A Well-known Pest. The Oyster-shell Scale is one of the best-known and most widely-distributed of the scale-insects, and is mentioned in almost every list of scale-insects and in bulletins on fruit insects from all parts of the country, but it is most destructive in the northern states and the higher, cooler parts of the southern states. Much of what is known of it throughout America has been published in condensed form as Circular No. 121 of the Bureau of Entomology of the United States Department of Agriculture, at Washington, D. C., written by A. L. Quaintance and E. R. Sasscer. The account of it as given in this BULLETIN is based not merely upon what others have already written (confirmed by our observations where possible), but also upon many observations and notes of our own and on the information gained from the many complaints from citizens of the State. Considerable data has also

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been given by Mr. R. W. Collett, now Superintendent of the State Test Farm at Swannanoa, Buncombe County.

Description. The full-sized female scales (these are most often observed) are about one-eighth of an inch long, narrow and brown in color. They may be nearly straight, or curved—sometimes almost into

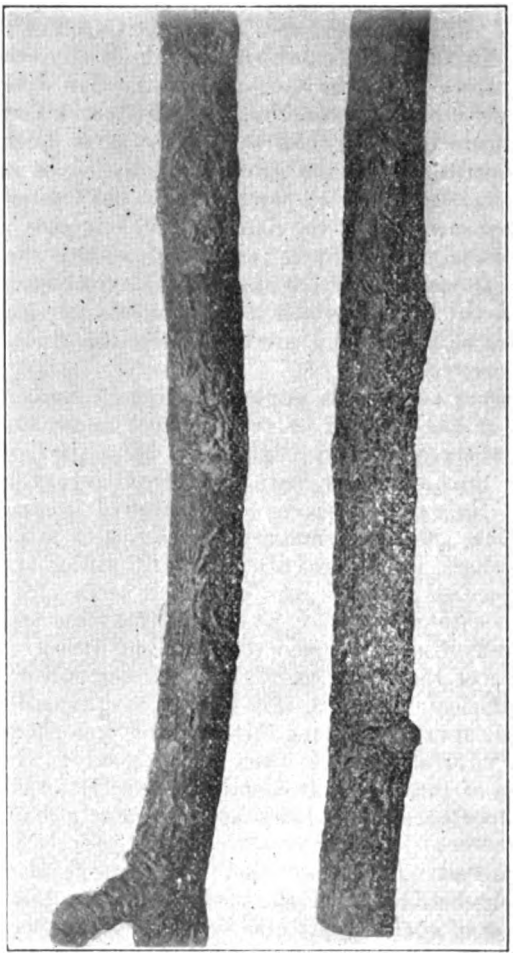

FIG. 1.—Apple twigs moderately infested with Oyster-shell Scale, shown slightly enlarged. Photo by C. L. Metcalf.

a half-circle. The front end of the scale—where the insect itself lies beneath—is narrower than the hinder end, which serves as a receptacle for the great number of over-wintering eggs. The male scale is somewhat similar, but smaller and shorter. The shape of the scales has suggested the common name of "Oyster-shell" for the species. There are of course all degrees of abundance on infested trees, from single scales

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here and there, to complete incrustation where the scales are so thickly matted together that the true bark can not be seen unless the scales are scraped away. A good idea of its appearance can be had by comparing this description with the illustrations.

Among the full-sized female scales will be found numerous scales of smaller size which are males, or younger partly developed females. In spring and summer one may (at times) find countless thousands of the tiny yellowish young, crawling about in search of suitable places to locate. In winter the young will not be crawling, but the scales, of different sizes, will be found. At this (winter) season if some of the grown female scales be turned over carefully the small pearly-white eggs will be found under the hinder part of the scale, while the dead body of the female will be under the front (more pointed) end of the scale.

FIG. 2.—Oyster-shell Scale on apple-twig, the twig whitened to better show the shape and size of scales. Natural size. Photo by C. L. Metcalf.

History and Distribution. Messrs. Quaintance and Sasscer state that the original home of the Oyster-shell Scale is not certainly known, but that it was introduced in New England at an early date, the first American account appearing in 1794, and that it is now known to be of world-wide distribution. They state that it "occurs in every State of the Union with the possible exception of South Dakota, Oklahoma, and Texas." But its known existence in all the other States makes it practically certain that it is in those States also, even though not a matter of actual record.

This is sufficient to show us that the Oyster-shell Scale is a well established, permanent pest, and that we have no reason to believe that it will "die out," which is an often-expressed hope in regard to pests of this character. Further on in this BULLETIN we consider its distribution in North Carolina in more detail.

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Plants Attacked by It. In our State the complaints of damage by the Oyster-shell Scale refer almost wholly to apple. Two complaints from Burlington (Alamance County) and one from Asheville refer to it as a pest on maples, while one complaint from Kings Mountain (Cleveland County) referred to its presence on pear.

It is known, however, to attack a great variety of plants. Quaintance and Sasscer state that it is "commonly found on apple, maple, horse-chestnut, poplar, willow and lilac," and they then give a list of over one hundred species of plants upon which it has been found, and among these we find such North Carolina kinds as: alder, aspen, apple, apricot, ash, Balm of Gilead, basswood, beech, box, box elder, buckeye (horse-chestnut), butternut, cherry, chestnut, clematis, currant, dogwood, elm, fig, ginseng, grape, holly, honeysuckle, lilac,* locust, maple, oak, peach, pear, plum, poplar, quince, raspberry, rose, sassafras, spruce, sycamore, umbrella tree, Virginia creeper, willow, walnut and yucca. They emphasize its importance as a pest of apple, maple and poplar.

This shows that the species has plenty of native plants upon which it may live—yet as before stated its chief standing as a pest with us is owing to its attacks on *apple,* though its recorded injuries to maples (at Burlington and Asheville) must not be overlooked. Mr. Collett has found it abundant on dogwood in forests far from orchard trees in Cherokee County. But we have not made a detailed record of all the plants on which we have found it in the State.

Summarizing this matter of its food-plants, so far as North Carolina is concerned, we may put it down that the Oyster-shell Scale is chiefly a pest of the apple, is also an enemy of maple, has been found abundant on dogwood, and may in future (if it is not sometimes already) be a noticeable pest on horse-chestnut, poplar, willow and lilac, where these are grown for shades or ornament. In addition it is possible for it to live on our other fruit trees, and a host of other forest and shade trees.

Damage in North Carolina. Considering the prevalence of this insect in our mountain region, the proof of really serious injury is not as abundant as might be expected. In that region it may be found in almost every apple orchard, usually in small or moderate numbers. In many individual cases, however, it becomes excessively abundant on parts of certain trees, or on the whole of certain trees, or even throughout the orchard. If a tree becomes infested while it is young, when all of the bark is tender, the body and branches may become completely encrusted and the tree may be stunted or killed. It does not breed and spread as rapidly as the San José Scale, hence the younger growth does not so quickly become infested. Hence it is not unusual to find a tree badly infested on trunk and branches of three to six years growth, while the newer growth of one to two years may have comparatively few scales. As the tree grows older there is a tendency to migrate toward the somewhat younger growth (three to six years) and the trunk and very oldest branches then show the scales mainly *under* the loose outer flakes of rough bark.

*We have at present no record of it on lilac in North Carolina, but in Maryland where the writer worked in 1897-98 it was frequently a pest on that plant.

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When the tree has become badly stunted the growth of each year may be only a few inches, and we have found three-year wood, badly infested, within a foot of the end of a twig.

The tendency to become destructively abundant on certain individual trees, or on certain parts of the tree, is shown in the following quotations:

WHITEHEAD, N. C. (Alleghany County), March, 1913.

The first I ever saw was about ten years ago,—it was out in an old field away from any other trees. It seems to affect trees worst out by themselves. I only know of one tree that has died from this scale, but others are almost hopeless,—I have one injured considerably. It is found more thickly on large limbs,—it is also found under scales of bark on the body of the tree where it would not be seen unless you look closely.

C. G. FENDER.

SWANNANOA, N. C., April 14, 1913.

I have two cases in mind (one here, and one at my home at Andrews, Cherokee County), where the trunk of large trees have been almost completely encrusted for years with no infestation of the branches.

We have one tree seriously infested in our orchard at Blantyre, but no general spread of the insect has taken place, notwithstanding the trees were planted on new land. It has been my observation that when trees are put on new cut-over land the Oyster-shell Scale will find them all in a year or two.

I once found a Swamp dogwood tree badly infested five miles at least from human habitation and in a very inaccessible place. This would lead me to suspect that the forest is quite generally infested.

R. W. COLLETT.

The last observation by Mr. Collett is very suggestive. The idea that the San José Scale is "all through the woods" is generally incorrect and misleading—but in the case of the Oyster-shell Scale it is nearer the truth, for this species has been in the country so long, and thrives readily on so many forest trees that orchards might easily and doubtless often do, receive their first infestation from trees in the surrounding forest.

Let us now consider a few cases actually observed in which injury by the Oyster-shell Scale has been severe.

The orchard of F. B. McCargo, at Mount Airy, Surry County, was visited by Mr. Z. P. Metcalf, Assistant Entomologist, in 1911, and was found to be very badly infested. The Oyster-shell Scale was abundant on many trees throughout the orchard, some trees had been killed, some fatally injured, and in other cases individual branches or twigs had been killed by it. The illustration on the front cover of this BULLETIN is from a photograph of a tree in this orchard.

At Morrisville, Wake County, the small family orchard of Mr. Malphus Sears was visited by the writer in April, 1913, and it was found that one or two trees from six to ten years of age had been completely encrusted, injured beyond hope, and had been cut down and piled as "brush" to be burned.

In 1904 Mr. R. W. Collett inspected the apple orchard on the grounds of the orphanage at Thomasville, Davidson County, and reported that the injury by the Oyster-shell Scale constituted as bad a case of de-

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struction as he had ever seen by any scale-insect not even excepting the San José Scale. Referring to this in a recent letter (April 14, 1913) Mr. Collett says:

"As I recall it now the trees were about four years old, and had rather good cultivation, etc., but the scale had killed many of them and all were so badly infested that I doubt not that they all died."

While the Oyster-shell Scale is evidently much more wide-spread in our mountain region than elsewhere, yet it is the opinion of the writer that on an average it is most destructive in those scattered localities through the "central" or "piedmont" sections where it has gained a foothold. In our card-catalogue record of complaints we find that in a large proportion of cases from the central section, we have noted that the twigs sent were "badly" or "very badly infested." A possible explanation of this is given when we come to consider the natural enemies of the Oyster-shell Scale.

Distribution in North Carolina. A study of the map explains much of what we have already said, and shall here say, regarding the distribution of the Oyster-shell Scale in North Carolina. The dots only show those localities from which we have received specimens, and of course there are numerous localities where it is present, but not in our records. It will be noticed that the western one-fourth of the State (including the mountains and the "foothills" region) is thickly enough dotted to indicate that it is well-nigh universal in that region, then the dots widen out to a scattering few as we come eastward. These more scattered eastern localities are: In Mecklenburg County, Matthews; in Stanly, Big Lick; in Rowan, Mount Ulla; in Davidson, Thomasville; in Chatham, Siler City and Frosty; in Alamance, Burlington; in Wake, Morrisville; and in Granville, Oxford.

It has been already stated that this insect is known to occur in every State of the Union except possibly South Dakota, Oklahoma, and Texas. This indicates its presence in all the States to the south of us (including Florida) and from this we would expect it to be widespread throughout the whole of North Carolina. It may be that it is *present* throughout all our State, for judging by its near relative, the San José Scale, it must have been sent into numerous eastern localities on shipments of trees;—and yet our records, kept carefully for over ten years now, show no record of it east of Raleigh, so the writer is forced to conclude that throughout the eastern part of the State it can not *now* be a serious pest, even if it is present and even if it should later become serious.

And yet, curious as it may seem in the light of what has just been said, it is our suspicion amounting almost to a settled conviction, that its *average severity* is greatest in the few more scattered localities *east* of the "foothill" region. It has long been our custom to make a card-catalogue note of every complaint of insect damage. Looking back through this record for some time previous to when this is being written we find that out of fourteen cases from the western end of the State we noted that this scale was "bad" in two cases, and "slight" or "moderate" in twelve cases. But during the same period out of only five cases, from

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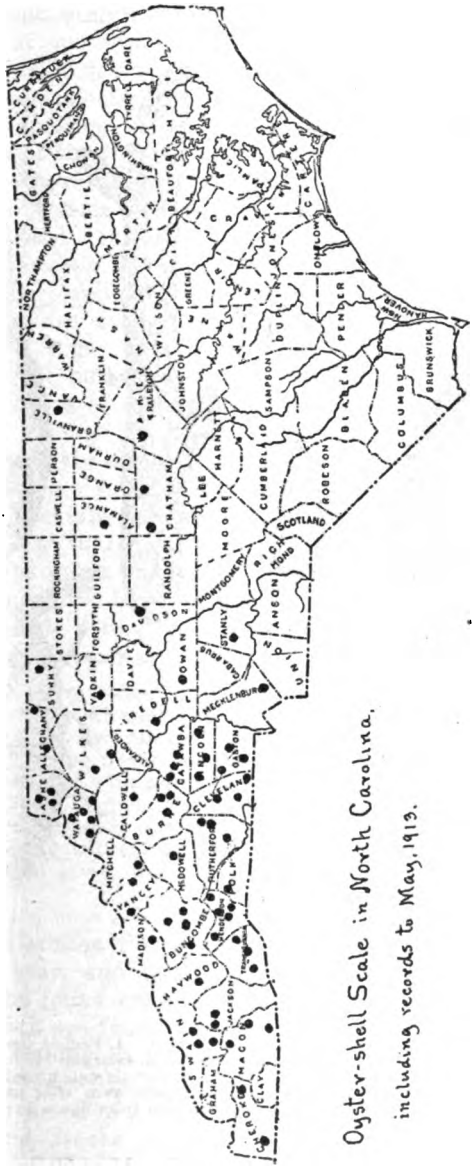

FIG. 3.

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the more eastern localities it was noted as "bad" in four cases, and "slight or moderate" in one case. We find that the cases at Matthews, Big Lick and Siler City are all referred to as "bad." The case at Morrisville, inspected by the writer, was certainly "bad," and the in-

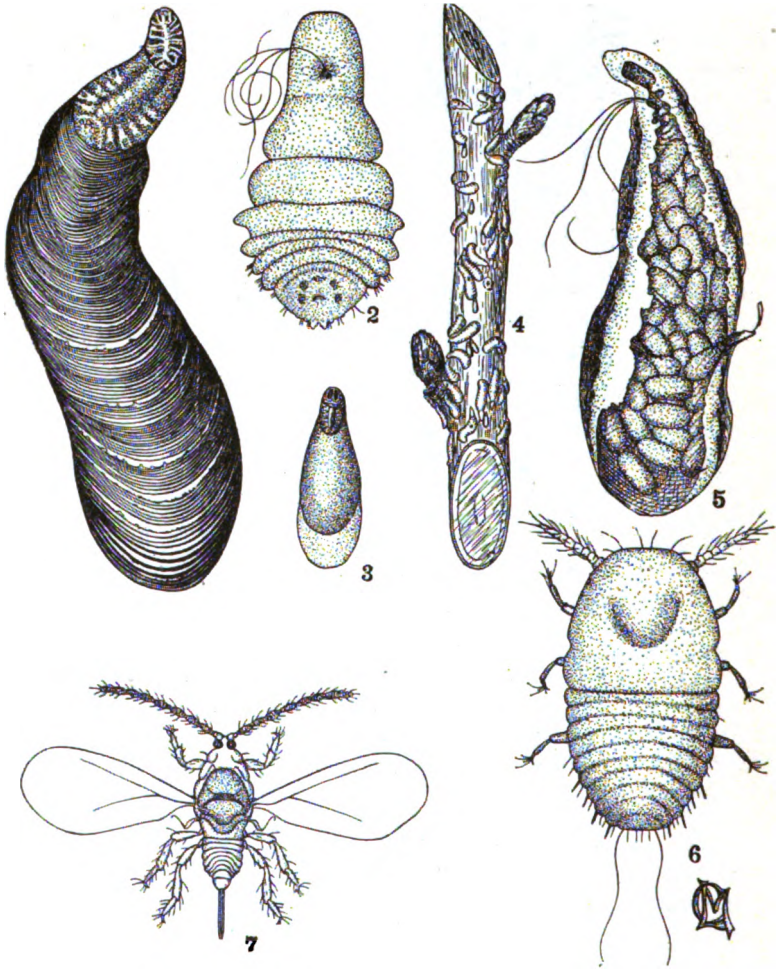

FIG. 4.—Above at left, mature female scale much enlarged. 2. Female insect removed from scale, much enlarged. 3. Mature male scale, much enlarged. 4. Infested twig, some scales with parasite holes, slightly enlarged. 5. Female scale turned over to show wintering eggs, much enlarged. 6. Young scale-insect soon after hatching, much enlarged. 7. Adult male, much enlarged (redrawn from figure by U. S. Dept. Agr.) Drawings by C. L. Metcalf.

festation at Thomasville was reported by Mr. Collett (1904) to be worse than he had ever seen by even the San José Scale.

It would be interesting to know whether this scale is actually spreading eastward. For some years all our records were from the more western part of the State, and with exception of Thomasville (1904)

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all of the more eastern records are in the last few years. If it is spreading eastward and becoming fully acclimated as it goes, then the longer warm season (suitable for its breeding) would in some measure account for its seemingly greater destructiveness in the more eastern localities. But our records are not sufficiently numerous to warrant conclusions on this point, and it would be necessary to make careful inspections in many localities over a period of years to be certain of the truth on this question.

Life-history of the Insect. Beginning the consideration of its life-history with the mid-winter season;—we may say that the winter is passed by the Oyster-shell Scale in the egg stage only. During the winter just closed (1912-'13) we closely examined many twigs in all degrees of infestation but found no living scale-insects. The eggs are abundant under well-developed female scales—but the body of the female insects are dead, shriveled and dry in mid-winter. Young scales have no eggs; ones nearly full size may have eggs, but not in full numbers; but those female scales which are of full size contain great numbers of eggs. These over-wintering eggs are oblong and pearly white. They hatch in early spring to tiny yellowish "lice" which crawl actively about in search of suitable places to locate on the bark. On finding a suitable location the insect inserts its beak into the bark to suck the sap—and once this is done it is believed that it remains attached at that spot. Soon the skin is "shed," the short legs disappear, and the insect has become covered by the first beginning of the "scale," which grows, hardens, and darkens with age, but the insect remains underneath, a tiny, yellowish creature of rather indefinite shape. Quaintance and Sasscer say:

> "The female molts twice in the course of her growth, and in the adult condition is entirely without legs or eyes, being nothing more than a reproductive sack with her sucking mouth-parts, through which the food is taken, inserted in the tissues of the plant. The adult male differs radically in that it is provided with antennæ (feelers) and one pair of wings. * * * During the process of metamorphosis (development) the mouth-parts of the male entirely disappear, and a second pair of rudimentary eyes assumes their place. Being without any means of taking food the adult male is naturally very short lived, its only mission appearing to be the fertilization of the female."

In North Carolina the Oyster-shell Scale presumably produces two broods each year, and quite possibly more when the season favors. Young may be found crawling in April, and dead specimens in many stages of growth are found on twigs in winter.

Time of Hatching in Spring. The exact time of hatching of the over-wintering eggs has always been emphasized as important, because while the first brood of young are crawling the trees may be sprayed to kill them—and as the young insects are very delicate the solutions would not have to be so strong as would be required to penetrate the protecting scale in winter.

Quaintance and Sasscer state that the time of hatching "will, of course, vary with the season, but in general will for any locality be shortly after the time of the falling of the blossoms."

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We have been to some pains to ascertain this point for North Carolina, and can present the following data:

April 5 and 7, 1913.—Twigs from Weaverville, Buncombe County, mailed March 31 and examined on these dates showed that a few were hatching on the 5th, and many on the 7th. Nearly all scales examined showed some hatching.

April 9, 1913.—Orchard infested with Oyster-shell Scale at Morrisville, Wake County, inspected on this date; most of eggs recently hatched,—few young now crawling,—but majority are fixed with skin not yet shed or recently shed. Hatching evidently at maximum April 1st to 7th. Twigs which were sent me from this orchard on March 31st hatched abundant young on reaching the office and soon thereafter.

April 11, 1913.—Examined twigs from Asheville, Buncombe County; hatching nearly over, few eggs still unhatched.

April 16, 1913.—Examined twigs just received from Azalea, Buncombe County; few young hatched and settled; under other scales are eggs or young which have not yet left the scale.

On this same point we quote from Mr. R. W. Collett (letter written April 20, 1909):

"We have some data collected in 1906 at Blantyre (Transylvania County), which indicates April 20th as date of freest hatching, though weather was cool for a few days before. All of them had settled down by May 1st. From April 20th to May 1st would certainly have been the time of easiest control. These notes were from careful observation."

Although the localities from which these notes were made vary from Morrisville, Wake County, at altitude of about 400 feet, to Blantyre, Transylvania County, where the apple orchard is nearly 2,500 feet elevation, and though the observations are for the well-separated years of 1906 and 1913, still, *April is positively indicated* as being the chief month in which the over-wintering eggs hatch. But an event of this sort will take place more in accordance with the season than with the calendar. In forward seasons they would certainly hatch in March in the more eastern localities; and in backward seasons they might not hatch until mid-May or later in the higher, cooler mountain localities.

In the orchard examined at Morrisville, most of the eggs were hatched by April 9 (1913), but the same trees were not yet in full bloom, which is slightly at variance with the criterion given by Quaintance and Sasscer.

As to the date of hatching of the second brood, we have no definite data, though in Tennessee Professor Bentley says that the time in that State is "along in July and August."

Growers whose trees are infested with this scale can easily determine the time of greatest hatching by watching for the appearance of the very small, yellowish, crawling lice, which when in great abundance give the twigs the appearance of having been lightly dusted with a yellowish powder.

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NATURAL ENEMIES.

It is always of interest to know what forces Nature of her own accord summons to aid us in the control of a destructive insect, and this knowledge becomes the more important in the case of species like this, which are ordinarily overlooked by the grower, or which, while capable of great injury, do not usually appear to be of sufficient importance to call for definite treatment.

Weather. Probably the most important natural check to insect increase generally, is the vagaries of the weather—the spells of heat or cold, moisture or dryness. Just to what degree the weather controls the Oyster-shell Scale we do not know, but we do know that in North Carolina the chief month for the hatching of the spring brood of young is April, and as April is notoriously a month of heavy showers, sudden changes and frosts, we must believe that the newly-hatched young are hampered considerably by the fickleness of the weather during their early life. We believe that heavy showers at the time when the tiny young are crawling wash off hundreds of them and leave them to perish on the ground. Sudden gusts of wind must blow away many more, and though by this means a few may find lodgment on other trees (and thus spread the infection) still the majority which happen to be blown off the trees must inevitably perish. But as before stated the *extent* to which the weather conditions aid us is uncertain.

Birds, like the winds, play a double role, some species devouring the scale-insects, while the same birds (or others) serve as a means of accidentally carrying the young crawling insects to new trees. Such small tree-inhabiting birds as the chickadees, brown creepers, tufted tit, kinglets, and warblers, are known to eat the scale-insects and individual cases have been placed on record where single birds have eaten large numbers of them. Yet so far as most of our birds are concerned the Oyster-shell Scale is too small to be noticed, or is so concealed by the scale itself that it is overlooked, and we can not regard birds as an efficient means of controlling this pest.

Fungous and Bacterial Diseases no doubt contribute somewhat to the control of this scale, though to what extent we do not know. They are known to exert some influence in the case of San José Scale and the Gloomy Scale, but definite data as to their activity against the Oyster-shell Scale is not known to the writer.

Parasitic and Predaceous Insects, however, are known to play a very definite part in the control of the species, and it is possible to form some intelligent idea of their efficiency, which is certainly considerable at times. We may divide these into three classes: (1) Parasitic insects of the order Hymenoptera, (2) Lady-beetles and their larvæ, and (3) Mites.

The exact species of parasites which infest the Oyster-shell Scale in this State are not yet fully known,* but it is known that these parasites are very actively at work, and that in some cases at least, they are a

*Specimens of parasites bred from infested twigs and submitted to Washington proved to be exclusively of the species *Aphelinus mytilaspidis*. Quaintance and Sasscer mention seven species among those "more commonly found."

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decided factor in holding the pest in check. During the months of March and April (1913) we requested sendings of infested twigs from a number of growers, and made careful examinations to determine the frequency of these parasites, also noting the frequency of scales which were torn open, presumably by lady-beetles, and in one case mites were found devcuring the eggs. The result was:

Twigs from	Normal—With Eggs	Parasitized	Torn Open, by Lady-beetles ?	Mites	Total
Dr. A. J. Eller, Ready Branch, Wilkes Co...	53	11	20	----------	84
W. H. Vestal, Siler City, Chatham Co.....	83	17	----------	----------	100
G. M. Goforth, Lenoir, Caldwell Co.....	95	1	4	----------	100
E. V. Harbeck, Weaverville, Buncombe Co.	81	18	----------	1	100
Malphus Sears, Morrisville, Wake Co.....	100	----------	----------	----------	100
W. T. Wray, Asheville, Buncombe Co.	91	9	----------	----------	100

Examination was also made of twigs from several other localities the result of which could not be fairly compared with those in the table owing to abnormal conditions, so we present the notes on them separately:

1. Twigs from W. L. Garren, Wolf Creek, Cherokee County. Most of the *twigs* were already dead so that the scales would not be normal. Of the old scales a moderate per cent showed parasite holes, and others torn open as if by lady-beetles, though part of this may be due to "weather-wear" after the insects had died.

2. Twigs from Mrs. F. E. Stroud, Frosty, Chatham County. *Twigs* mostly dead or nearly so, and scales on some look dark as if treated with oil or otherwise. Few young in evidence. Counts made from twigs which looked normal; 100 scales overturned; no living parasites nor parasite-holes found, though *all* twigs were examined for this; considerable number torn open as if by lady-beetles.

3. Twigs from W. L. Gash, Azalea, Buncombe County. Scales very dark, almost abnormal in appearance. Few young have hatched and settled, but majority of scales contain only dead insects. A goodly per cent are with parasite holes.

We have already remarked upon the seemingly greater severity of this pest in the more scattered eastern localities infested by it. The studies above reported may throw some light upon this. In the cases at Morrisville, Wake County; and Frosty, Chatham County; there was absolutely no evidence of the parasites, and in the twigs from Lenoir, Caldwell County (at edge of mountains) only one parasitized scale was found out of 100 examined. However, in the twigs from Siler City, Chatham County, the percentage of parasites was fully up to normal (17%).

The lady-beetles also seem to be, if anything, less active against this scale in the more eastern localities than in the mountains. No evidence of their work was noted on the twigs from Morrisville or Siler City, though there was some evidence of them on twigs from Frosty.

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Upon the whole we are led to believe that the parasite and lady-beetle enemies (especially the former) of the Oyster-shell Scale are not so universally present and active in the more eastern localities as they are in the mountains. During the inspection of the orchard at Morrisville (April 9th) the only evidence we found of natural enemies on any of the trees was a single specimen of a larva, which was presumably of the "twice-stabbed lady-beetle," which was feeding on young scales of this year's hatching. Yet that the lady-beetles sometimes occur in considerable numbers is evidenced in a note by Mr. Collett, referring to an infested tree at Andrews, Cherokee County, in which he says: "A colony of lady-beetles seem to spend their life on and around the scale-infested tree. In the summer I have seen hundreds of larvæ on this tree."

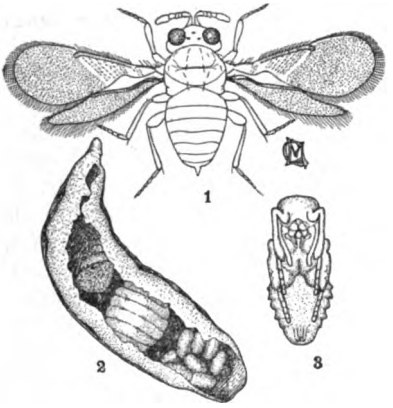

FIG. 5.—Adult parasite of Oyster-shell Scale. 2. Larva of parasite in scale with scale-insect one side and eggs on other. 3. Pupa of parasite. All much enlarged. Drawn from specimens by C. L. Metcalf.

Mites have been found among the eggs under over-wintering scales in two instances, one of which is indicated in the preceding table. In one case five individuals were under one scale, one of them having its head buried in an egg of the Oyster-shell Scale. But their number seems too small to consider them as an important aid in checking this scale.

It is to be presumed that some other predaceous insects, like the smaller ground-beetles and larvæ of the lace-wing flies, prey upon the young scale-insects to some extent.

From the table given it is seen that in a total of 584 scales examined from six different localities 81 showed attack by parasites, lady-beetles or mites. This gives nearly 14 per cent as the average killed by these natural enemies during the winter, and this is enough to be really a helpful item.

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REMEDIES FOR THE OYSTER-SHELL SCALE

Our Recommendation.

1. Based on present knowledge and experience our first recommendation would be to use what are known as the "Soluble Oils" (oils so prepared that they mix easily with water) at the strength of *one gallon of the oil mixed with eight or ten gallons of water,* this to be applied as a spray during late winter before the buds of the tree begin to open. The names and addresses of several firms who manufacture these oils are given on page 21.

2. Should the grower not wish to use the soluble oils we would advise spraying the trees with kerosene emulsion at a strength of 25 per cent oil, making the application in late winter before the buds begin to open. Formula and directions for use of kerosene emulsion are given on page 22.

3. If the grower does not desire to use either the commercial oils nor the kerosene emulsion he may then depend on the usual lime sulphur washes—either the commercial ones at a rate of one gallon to eight gallons of water, or the home-made, fire-boiled wash prepared by the formula of 15 pounds lime, 15 pounds sulphur, to 50 gallons water. Names and addresses of firms who manufacture the ready-made wash are given on page 22, and directions for preparing the home-made wash are given on page 23. But our tests and observations, both with the Oyster-shell Scale and with others which are likewise protected with as hard a scale as this, indicate that the oil washes are more penetrating and more effective than the lime-sulphur preparations.

4. If the infestation is discovered too late in winter to make the treatments before the buds open, then we would advise that the trees be sprayed during the *last half of April or first half of May,* using kerosene emulsion at strength of 15 per cent oil. This is based upon the time of hatching of the eggs (already discussed) and the time recommended is such as to reach the majority of the young before the scale has become fully formed.

5. In any case, no matter what remedy is used, it is best that any dead, useless or superfluous branches be cut out, so that the spray will more thoroughly reach what remains. Do the pruning *before* making the application for Oyster-shell Scale.

TEST OF REMEDIES.

In order that the reader may understand the basis for the recommendations given we give a brief account of some tests performed.

During late winter and spring of 1912 Mr. Z. P. Metcalf, then Assistant Entomologist in this office, conducted some spraying experiments against the Oyster-shell Scale in the orchard of Mr. F. B. McCargo, near Mount Airy, Surry County. The orchard was very generally and very seriously infested. Tests were made with several ready-made preparations, as follows:

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SPRAYINGS FOR OYSTER-SHELL SCALE, 1912

Material Used	Strength Mixed With Water	Dates of Spraying	Number Tree	Result
1. Soluble Oil	1 gal. to 10 gals. water	March 17	32	Very good
2. Soluble Oil	a 1 to 10 b 1 to 30	a March 17 b June 10	16	Very good
3. Soluble Oil	1 to 30	June 10	16	Not satisfactory
4. "Spray-On (a soluble oil material)	1 to 10	March 17	36	Very good
5. "Spray-On"	a 1 to 10 b 1 to 30	a March 17 b June 10	18	Very good
6. "Spray-On"	1 to 40	June 10	15	Not satisfactory
7. "One-for-All"*	2 to 5	March 17	17	Very poor
8. Lime-Sulphur	1 to 8	March 17	29	Fair
9. Lime-Sulphur	a 1 to 8 b 1 to 20	a March 17 b June 10	16	Fair

It will be noticed that the trees used in tests Nos. 2, 5, and 9 received *two applications,* on March 17th and June 10th (the latter at diluted strength), but in each case the result was not noticeably better than when only the one stronger application was given on March 17th.

Also, in tests 3 and 6 the trees were treated on June 10th, but not in March. In these tests weaker solutions were used, and the results were "not satisfactory," from which we conclude (in view of the now-established fact that the eggs hatch mainly in April) that the June treatment was too late to give the best results against the young.

In tests 1 and 2, in both of which the soluble oil was used at 1 gallon to 10 gallons water, in March, the results were "very good," while in tests 8 and 9 in which the lime-sulphur was used at 1 gallon to 8 gallons water, in March, the results are given as "fair." This is our reason for asserting that the oils seem superior to the lime-sulphurs, presumably on account of their greater penetration.

"Spray-on," which was essentially one of the class of insecticides now generally known as "soluble oils," acted the same when being used, and gave similar results.

"One-for-all" did not do what might have been expected from its comprehensive name.

* * * * * * * *

It is freely admitted that these tests do not cover *all* desirable considerations. There was no test of the usual home-made kerosene emulsion, nor of the fire-boiled lime-sulphur, nor does it show entirely satisfactory tests as against the young which hatch in April, for the June treatments were not satisfactory, and there were no treatments in late April or early May, which we would expect to be the best time to reach the young.

To offset these possible shortcomings in the tests it may be said that the general action of kerosene emulsion and of fire-boiled lime-sulphur

*"One-for-All" was a material supposed to combine the good qualities of both the oil and the sulphur sprays.

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are already quite well known and we can feel fairly safe in our recommendations concerning them, even though they were not included in the tests. Owing to the time and funds available for the tests it was considered best to depend upon the materials shown, especially as the ready-made "soluble oils" and "lime-sulphurs" are rapidly coming into general use among fruit-growers.

As to the spring spraying to reach the young we are forced to believe that it is of secondary importance anyway. Late winter is already the "accepted time" to spray for the control of San José Scale on fruit trees, and it is also now evident (tests 1 and 2) that a treatment at that season with the soluble oils gives good results against the Oyster-shell Scale. We would only advise the grower to give the later treatment to kill the young in case he has for some reason been unable to give the winter treatment. In the discussion which follows it will be seen, however, that Mr. W. L. Garren, of Cherokee County, reports good results from spraying in the spring. The testimony which we now give, furnished us by actual growers, can not be regarded as technical tests, because we are uncertain as to such details as the exact strengths used, exact times of treatments, and exact results, but their testimony can be considered as fairly strong evidence.

REPORTS OF SUCCESS BY GROWERS.

On April 23, 1912, Mr. W. L. Garren, Wolf Creek, Cherokee County, sent infested twigs and asked for remedies. In our reply we recommended kerosene emulsion at strength of 15% oil. In a letter dated March 31, 1913, Mr. Garren says: "The tree that was infested one year ago has scarcely a scale on it. I used the kerosene emulsion as you directed and almost exterminated them."

Looking over some of the older notes in our office we find the following, under date of June 19, 1901: "Mr. Ed. Underdown, manager of the Cone orchards at Blowing Rock (Watauga County), shows me apple trees which have been affected, but spraying with 25% oil emulsion, and washing with strong lye soap, has almost eradicated it." These treatments had been given in winter.

Another case of reported success is that of Mr. S. J. Luther, Candler, Buncombe County, N. C., who sent infested twigs in March, 1908, but who, when requested to send us infested twigs in 1912, replied: "I am pleased to tell you I can't send the infested apple twigs as per your request. At the time you refer to I mailed several twigs to your department and received BULLETIN treating of this Oyster-shell Scale and how to get rid of it, which I applied as directed, and with two applications killed everything clean and now have clean, healthy trees." We fail to find copy of the letter we wrote Mr. Luther in 1908, but if he applied remedies by our recommendations it was probably kerosene emulsion at 25% oil if to be used in winter, and at 15% if applied when there were blossoms or foliage on the trees.

Still another case is that of Mr. B. C. Price, of Poor's Knob, in the Brushy Mountains (Wilkes County), who made complaint in March, 1908, but who wrote in April, 1912, that he could not furnish infested

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twigs, because "I have been using my spray pump and glad I can not furnish them out of my orchard."

Mr. T. N. Woodruff, of Lowgap, Alleghany County, wrote on April 6, 1912: "This scale has been a hard one for me to manage until I tried the self-boiled lime-sulphur; now I have only two small trees infested, and these were overlooked last year." As the self-boiled lime-sulphur is a spring and summer treatment we must believe that his sprayings reached either the young which hatched in April, or the young of the second brood which hatched in the summer.

There is yet another experience to relate. Mr. R. W. Collett, now Superintendent of the Buncombe Test Farm, on April 14, 1913, writes: "In 1902 or 1903 I sprayed the Stuart orchard (in Cherokee County), using standard strength whale oil soap, with the result that the following summer you and I made thorough examination and failed to find scale, though the infestation had been quite serious—some of the trees had died."

The whale oil soap here referred to is made and sold by Jas. Good, 939 N. Front street, Philadelphia, Pa. Used at the rate of 1½ pounds dissolved in 1 gallon of hot water, and applied in winter, it was for many years one of the favorite remedies for scale insects, and it is still used to considerable extent.

FORMULAS AND DIRECTIONS FOR THE REMEDIES.

Soluble Oils (also called "Mixible Oils"). These are oils so prepared that they will mix readily with water, thereby making it possible to easily obtain any desired strength without the trouble of preparing the old-time kerosene emulsion. They furnish an excellent remedy for many scale-insects, and owing to their powers of penetration into remote crevices and through resistant scales they are preferred by many above the lime-sulphur washes. However, their effect as against fungous diseases seems to be decidedly less than the lime-sulphurs. For use against the Oyster-shell Scale we give them first choice, although when once it is under control we believe that it would be held in check (and the orchard would be more benefited in other ways) by depending on the lime-sulphur washes.

Although there are several different brands of the soluble oils on the market, yet they are quite similar in general character and action, and the same strengths of each seem to give about the same results.

Used at the rate of 1 gallon of soluble oil mixed with 10 gallons water, and applied in late winter (March, in our tests), they have given good results against the Oyster-shell Scale. If used at rate of 1 gallon to 8 gallons water the results would presumably be a little better, and apple trees are not hurt by this strength if it is applied before the buds open.

The following firms manufacture and sell these soluble oils (and there are doubtless others):

B. G. Pratt Co., 50 Church St., New York City ("Scalecide").
Thomsen Chemical Co., Baltimore, Md. ("Orchard Brand Soluble Oil.").

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Kerosene Emulsion. This is an old-time home-made standard remedy for scale-insects, plant-lice, etc. Once the "stock emulsion" is prepared it can be kept for a long time and diluted as needed to any desired strength. The "soluble oils" are essentially a manufactured substitute for kerosene emulsion. Kerosene emulsion is prepared as follows:

Kerosene (coal oil)	2 gallons.
Soap (laundry or soft)	½ pound.
Water	1 gallon.

Shave the soap into thin pieces in the water, heat to boiling, and stir to dissolve the soap. *Remove from the fire* and pour in the two gallons oil, and churn the whole mixture together vigorously for several minutes. This may be done by pumping it through the spray pump, directing the nozzle back into the mixture. When thoroughly mixed it will be of a light creamy nature and will mix readily even with cold water. This gives what is known as the "stock emulsion" and is 66 per cent oil. Now,

To get 15 per cent oil, add 10 gallons of water.
To get 25 per cent oil, add 5 gallons of water.

For use in late winter before the buds have opened, as a remedy for Oyster-shell Scale, we recommend that the kerosene emulsion be used at strength of 25 per cent oil.

For use in late spring (late April or early May) to kill the newly hatched young of the Oyster-shell Scale, we recommend that it be used at strength of 15 per cent oil.

NOTE—The chief objections to kerosene emulsion are the trouble of preparing it and the care needed in getting the exact per cent of oil. One must be careful, therefore, to follow the *proportions* here given so that the mixture when ready to be sprayed on the trees will be of the desired strength—not more and not less.

Commercial Lime-sulphur. These are solutions which contain lime and sulphur so combined that all one has to do is to mix it with the required amount of water, and it is ready to apply to the trees. There are a number of firms which sell these ready-made solutions, some of which are here listed:

Thomsen Chemical Co., Baltimore, Md.
Jas. A. Blanchard Co., New York, N. Y.
Vreeland Chemical Co., 26 Dey St., Hudson Terminal Bldg., New York, N. Y.
Niagara Sprayer Co., Middleport, N. Y.
Grasselli Chemical Co., Cleveland, Ohio.

For winter use the manufacturers usually recommend that the ready-made lime-sulphur be applied at strength of 1 gallon to 10 gallons water, but many growers and experimenters show a tendency to use it at the greater strength of 1 gallon to 8 gallons water, and apple trees will stand this strength without injury if it is applied before the buds open.

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But it must be distinctly understood that at this strength (either 1 to 8, or 1 to 10) it must not be used after the buds have opened.

If the grower for any reason wishes to depend on the ready-made lime-sulphur to control Oyster-shell Scale, and can not give the above mentioned winter treatment, then we advise that he use it at rate of 1½ gallons to 50 gallons water, and apply it in late April or early May.

Home-made Lime-sulphur Wash. This was for some time the chief remedy for scale-insects of the orchard, and is still the chief reliance of many thoroughly up-to-date growers, though it is being displaced to a great extent by the more convenient commercial washes. It is prepared as follows:

Stone Lime (unslaked)	15 pounds.
Sulphur (Flowers)	15 pounds.
Water (to make)	50 gallons.

Heat from four to six gallons water to boiling in large iron or brass kettle. Mix the sulphur with enough hot water to make a thin paste and pour it into the kettle with the hot water. Now add the lime, part at a time, and as it slakes dash in a little cold water as needed, to keep it from boiling over or to keep it from becoming dry. Keep the fire going and stir frequently. As the slaking ceases, keep it boiling from the fire for half an hour longer, then dilute with water (cold is all right) to make 50 gallons; strain through a fine wire screen or cloth to remove sediment, and spray.

This wash at the strength here given is only for use in winter before the buds open. The later the treatment is made the better, so the buds have not yet opened.

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LEAF TOBACCO SALES FOR MAY, 1913.

Pounds sold for producers, first hand	24,471
Pounds sold for dealers	2,233
Total	26,704

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THE BULLETIN

OF THE

NORTH CAROLINA

DEPARTMENT OF AGRICULTURE

RALEIGH

Volume 34--No. 7. JULY, 1913. Whole No. 186.

LEGUMINOUS CROPS IN NORTH CAROLINA

PLOWING UNDER COW PEA VINES.

SENT FREE TO CITIZENS ON APPLICATION.

Entered at the Post-office at Raleigh, N. C., as second-class matter, February 7, 1901, under act of June 6, 1900.

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LETTER OF TRANSMITTAL

MAJ. W. A. GRAHAM,
Commissioner of Agriculture.

SIR:—The enclosed manuscript on the subject of Leguminous Crops is in response to a demand from the farmers of the State desiring information in regard to them. I therefore recommend it for publication as the July BULLETIN.

In the preparation of this I have had access to the bulletins of the United States Department of Agriculture, from which I have gotten valuable information about many of the crops mentioned. I am also indebted to that Department for the use of many of the illustrations used in this Bulletin.

The chapter on bur clover was taken almost exclusively from the July, 1904, Bulletin of the North Carolina State Board of Agraculture, which Bulletin is now out of print.

Respectfully,
T. B. PARKER,
Director of Farmers Institutes.

Approved for publication:
W. A. GRAHAM,
Commissioner of Agriculture.

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CONTENTS

	PAGE
Leguminous crops in North Carolina	7
Importance of nitrogen	7
Bacteria	7
Bacteria cultures	8
Inoculating with soil	9
Humus	10
Lime	11
Hay	11
Drainage	11
Red clover	12
Red clover seed	12
Time of sowing clover	12
Fertilizer for clover	13
Sowing seed	15
Clover hay	15
Mammoth clover	16
Dodder in clover	16
Crimson clover	19
Crimson clover hay	20
Time of seeding	21
Bur or spotted clover	23
Inoculation of soil for bur clover	24
Bur clover for soil improvement	24
Bur clover for pasturage	27
Soil	30
Preparation of soil and seeding	30
Reseeding	32
Bur clover as a cover crop and soil protector	32
Sweet clover	35
Lespedeza or Japan clover	36
Alfalfa or lucerne	38
Preparation of land	39
Seeding and inoculation	39
Treatment first year	41
Alfalfa enemies	43
Leaf spot	43
Vetches	43
Cow peas	47
Pea vine hay	48
Soy beans	49
Varieties	50
Preparation of the soil	51
Soy bean hay	52
Inoculation	53
The velvet bean	54

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ILLUSTRATIONS

PAGE

FIG. 1—Rod forms of bacteria from a fenugreek nodule; magnified 2,000 times 8
FIG. 2—Branching forms of bacteria from a clover nodule; magnified 2,000 times 8
FIG. 3—Roots of garden pea showing nodules..... 9
FIG. 4—Comparative water holding powers of soil..... 10
FIG. 5—Stems of red clover in different stages of bloom..... 13
FIG. 6—Young red clover plant showing tubercles on roots..... 14
FIG. 7—Red clover field, showing the effect of top-dressing with manure. The area in the immediate foreground received no manure; the area immediately behind received a light application, resulting in a very vigorous stand of clover..... 15
FIG. 8—Field dodder on stems of red clover. At the right the dodder is shown in flower; at the left, in the mature or seed-producing stage 17
FIG. 9—A single plant of crimson clover..... 18
FIG. 10—Crimson clover in an old corn field. The clover was seeded in the corn at the last cultivation. A fodder stack is to be observed in the middle foreground. The corn stalks have been removed to avoid difficulty in mowing the clover..... 19
FIG. 11—Crimson clover and wheat in mixture. In the foreground the crop has been cut and fed green to stock. The remainder was cut the next day for hay. The grain prevents the crimson clover from lodging 20
FIG. 12—A crimson clover failure on ground too poor in humus..... 22
FIG. 13—Bur clover stem, showing leaf, bur and flower development..... 23
FIG. 14—Bur clover plant, Edgecombe Test Farm, May 12, 1903..... 25
FIG. 15—Cotton after bur clover, fertilized with acid phosphate and kainit only (K. P.) Yield per acre 1,620 pounds seed cotton..... 26
FIG. 16—Cotton close to plot shown in Fig. 15, fertilized with acid phosphate, kainit and cotton-seed meal (N. P. K.). Yield per acre, 1,220 pounds seed cotton..... 26
FIG. 17—Corn after bur clover, 1903, Edgecombe Test Farm.....28
FIG. 18—Bur clover after cotton, clover 15 inches high, April 15, 1903... 31
FIG. 19—Bur clover after cotton on sandy land, Edgecombe Test Farm, May 12, 1903..... 33
FIG. 20—Sweet-clover plant near the close of the second season's growth.. 34
FIG. 21—Roots of melilotus (sweet clover) showing nodules..... 35
FIG. 22—Hogs pasturing on sweet clover in Iowa in late October..... 36
FIG. 23—A plant of lespedeza, showing the upright growth made where the stand is reasonably thick..... 37
FIG. 24—Roots of young alfalfa plants showing nodules..... 39

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PAGE

FIG. 25—Alfalfa seedlings at the beginning of winter. (1) Seeded Aug. 15, 13 inches high; (2) seeded September 1, 5½ inches high; (3) seeded September 15, 2¼ inches high. The large, early-seeded plants are much better able to withstand the winter than are the small, late-seeded ones..... 40
FIG. 26—Mature dodder plants on an alfalfa stem..... 42
FIG. 27—Stem, flowers and seed pods of hairy vetch..... 44
FIG. 28—Hairy vetch and rye growing together in Virginia..... 45
FIG. 29—Hairy vetch (volunteer crop) after inoculation on sandy land, Edgecombe Test Test Farm, May 12, 1903. Yield, 5,100 pounds per acre 46
FIG. 30—Field of Iron cowpeas broadcasted thinly..... 47
FIG. 31—Method of curing cowpea hay..... 48
FIG. 32—A plant of the Mammoth variety of soy bean, showing its characteristic habit of growth. Height, 40 inches..... 50
FIG 33—A field of the Mammoth variety of soy bean in North Carolina.. 51
FIG. 34—Roots of soy bean showing nodules..... 52
FIG. 35—Roots of velvet bean showing nodules..... 53

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LEGUMINOUS CROPS IN NORTH CAROLINA

By T. B. Parker.

The aggressive campaign that has been waged for the past few years in the interest of better farming by the use of legumes has not been without its reward. As farmers have become better acquainted with these crops and as they have more fully understood their economy in crop production, the greater has grown the demand for information about them. Nor is this surprising, for when we recognize the value of cover crops, and the advantage of legumes as cover crops, as preventers of erosions, conservers of plant food which might otherwise be leached out of the soil; and, also their power to add to the supply of plant food, deepen the soil and add to its supply of humus; to improve its physical condition, and, in addition, their value as hay and grazing crops, to the progressive farmer they become very interesting. But to properly perform the functions of a winter cover crop, those adapted to that purpose should be sowed sufficiently early to so cover the soil before their growth is stopped by cold weather as to protect it from erosion. But when they are sowed even too late for that, their root system may make enough growth to stop a large part of the waste of plant food that would be leached out of a bare soil. Then it is a well known fact that of the three essential elements in plant food, nitrogen, phosphorus, and potassium, one or more of them is deficient in most of our cultivated soils. Of these, nitrogen is the most important, and, from recent investigations, has proven to be the most elusive. Also it has been shown by experiments in Germany and also in this country (see New Jersey Bulletins, Nos. 221, 224) that only from 40% to about 65% of the nitrogen applied to crops is recovered or taken up by the crops. This makes the subject still more interesting.

Importance of Nitrogen.

We pay about five times as much per pound for nitrogen, when purchased in fertilizers, as we do for either phosphoric acid or potash. If then the crop recovers only from 40% to 65% of the nitrogen applied, that taken up by the crop becomes very expensive. To lessen this expense we need to procure our nitrogen as cheaply as possible.

Bacteria.

It is an established fact that all legumes have the power of securing free nitrogen from the air through the agency of bacteria peculiar to the particular kind of legume grown. For instance, the cowpea will thrive only when the bacteria peculiar to the cowpea is present; the soy bean requires the presence of bacteria adapted to that plant; crimson clover will thrive only when the bacteria peculiar to that plant is present; and so on throughout the entire list, with certain exceptions. Those now known are: garden or English peas, and the vetches can

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become inoculated with the same bacteria. Alfalfa, sweet clover and Burr clover bacteria will inoculate either plant. There may be some others where the same bacteria will inoculate both plants, but it will be safest not to rely on that supposition. To illustrate: If you are going to sow red clover, do not depend on bacteria peculiar to crimson clover for inoculation. Neither expect a red clover soil or culture to inoculate crimson clover. Crimson clover may grow better after red clover than if red clover had not grown on the land. So it might after any of the legumes from the fact the soil contains more nitrogen and is in better

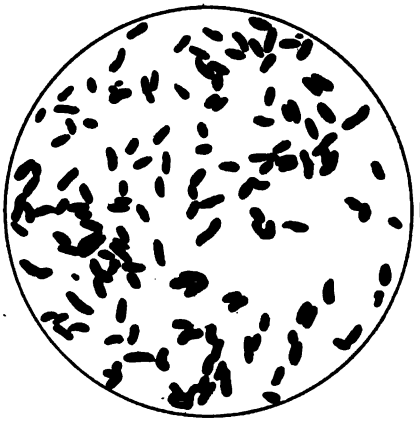

FIG. 1.—Rod forms of bacteria from a fenugreek nodule; magnified 2,000 times.
U. S. Bulletin No. 214.

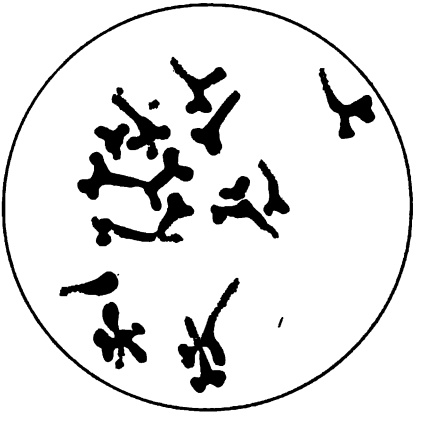

FIG. 2.—Branching forms of bacteria from a clover nodule; magnified 2,000 times.
U. S. Bulletin No. 214.

condition than it would have been if the legume had not been grown on the land, and not because of the presence of bacteria in the soil. Therefore, in growing any of the legumes where they have not grown successfully before, either get soil from a field where the specific crop to be grown has been successfully grown within the last year or two or procure some of the nitrogen cultures sent out by reliable manufacturers of these.

Bacteria Cultures.

There have been within the last few years great advances and improvements made with these cultures. From Farmers' Bulletin No. 214, United States Department of Agriculture, I take the following:

"G. L. Thomas, experimenting with field peas on his farm near Auburn, Maine, made a special test with fertilized and unfertilized strips, and stated that inoculated seed did as much without fertilizers of any kind as seed not inoculated but supplied with fertilizer (phosphate) at the rate of 800 pounds and a ton of barn yard manure per acre. * * * Jeremiah Gardner, of Gaffney, S. C., wrote: 'My cow peas were better than those of others who used commercial fertilizers. They ripened early and evenly. I consider inoculation a boon to agriculture.'' Mr. D. L. Farrior, of Raleigh, N. C., said that he applied commercial nitrogen culture to seed for sowing several acres in clover on his farm near this city last spring, and where he applied the

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culture his stand was perfect and where he did not treat the seed with the culture, his clover was a failure. I have known alfalfa seed treated with culture and the growth was as marked as if a heavy application of stable manure had been applied to the land.

FIG. 3.—Roots of garden pea showing nodules.
U. S. Bulletin No. 214.

In applying commercial cultures always follow directions closely, else the results may be disappointing.

Inoculation with Soil.

If one has soil upon which the specific crop to be grown has been grown successfully, he can use the soil to inoculate with. A good plan is to wet the seed and roll them in soil and sow them in that condition. If one has a wheat drill with a fertilizer attachment the soil and seed can be put in that and evenly distributed on the land in that way. The soil can also be broadcast over the land, at the rate of 400 or 500 pounds per acre, the seed sown and both immediately harrowed in. This had best be done on a cloudy day or very late in the afternoon, so as to prevent the sun from drying out and killing the bacteria. But do not mix the inoculated seed with commercial fertilizer.

Our soils will be with us as long as time shall last. They will need nitrogen as long as they are cultivated or as long as crops of any kind are taken from them. The nitrate of soda beds of Chili may become exhausted long before our farmers will need no more nitrogen; the natural guano beds may become unknown; but the air, four-fifths of which is nitrogen, will be with us as long as time shall last. As nothing is lost in nature we are not robbing it to any appreciable extent when we take nitrogen from the air by the aid of the bacteria upon the roots of the legumes, because it soon escapes in gaseous form and goes back into the air and is again ready to be taken up and to be used by the grow-

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ing plants, thus performing its cycle in plant and animal life. For this reason we need to study the various legumes and increase the acreage in those adapted to our soils and conditions.

In addition to adding nitrogen to the soil, being deep rooted plants, they help to deepen and to drain our soils, also to take plant food from the lower depths, where shallow-plant roots could not get it, and bring that to the surface and leave it there in the leaves, stalks, etc., of the plant where it becomes available for after crops. They also add humus to the soil, thereby adding to the water storage capacity of our soils.

Humus.

Most of our soils that have been cultivated for any length of time are deficient in humus. Perhaps it may be truthfully said that the greatest need of our upland soils today is humus. Many of our farmers fail to appreciate its great value. By humus I mean decaying vegetable matter or vegetable mould. It plays a very important part in crop production. It supplies plant food and is also a storehouse or reservoir for moisture to dissolve plant food. (See Fig. 4.) This is very important. Without moisture no land is productive. The most fertile field can produce nothing without moisture to dissolve the plant food which it

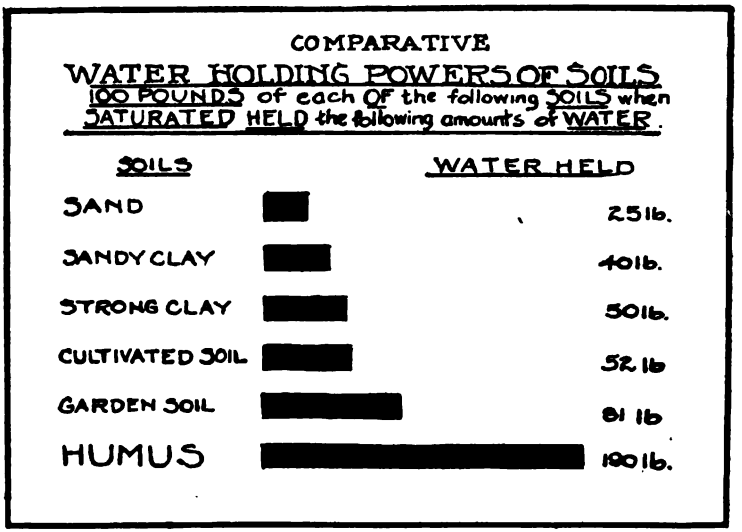

FIG. 4

contains. Humus also adds to the availability of the inert plant food in the soil. Decaying vegetable matter produces acids that act on the locked-up potash and other forms of plant food in the soil and makes them available to the growing plant. All soils, even pure sand and clay, contain some plant food, but it may be unavailable to the plant. Humus aids in unlocking this plant food and makes it available.

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Lime.

Most legumes fail to grow in acid soils. They require a neutral soil or one free from acidity. There are some exceptions to this general statement which will be noted under the several heads which follow.

It is often the case that an application of lime even on our sandy soils makes it possible to grow certain of the legumes that can not be made to grow without liming the soil.

In applying lime regard should be had for the kind of lime to be applied. Caustic or freshly burned lime is very active in attacking humus in the soil and is quick in its action regarding acidity, while unburned lime is less active and larger applications can be made. In caustic or freshly burned lime it is safe to apply from 1,000 pounds to one ton according to the acidity of the soil per acre. This should be slaked with water to the point of being in a fine powder, but not wet and sticky.

This may be applied by putting the lump lime out in small piles, a peck or half bushel in a pile, and allowing it to slake before scattering it, or it may first be slaked and applied with a lime distributor, a manure spreader, or direct from a wagon. If the latter, the team should be driven against the wind so that the lime would be carried away from the men and from the team. The lime can be shoveled from the wagon and scattered over the land. If a lime distributor or a manure spreader should be used, they should be regulated so as to apply the quantity wanted per acre.

Fifty-six pounds of well burned unslaked lime is equivalent in lime value to 100 pounds of unburned or carbonate of lime. It is equivalent to 74 pounds of properly made hydrated lime. It is also equivalent to 100 pounds of lime that has been exposed to the air for quite a while.

Hay.

Most of the legumes when cut at the proper time and well cured make a very fine quality of hay. Where the hay can be used to advantage on the farm, it is much better to make the crop into hay and feed it to live stock; but if the land needs it more than the live stock does, then it may pay better to turn it under for soil improvement. Each farmer may decide this for himself. However, it may be well to remember that feeding hay to live stock does not add anything to its fertilizing value. Therefore the manure from a given quantity of hay fed to live stock and the manure returned to the land will not contain as much plant food as the grass would have furnished if it had been plowed under instead of having been made into hay and fed to the live stock.

Drainage.

Drainage is essential for good growth and development of the legume families. The bacteria necessary for the growth of the legumes can not live and perform their work in wet or poorly drained soils, except possibly in the case of cow peas and soy beans, and they do much better in well drained soils than they do in poorly drained soils. Lime and fertilizers seem to be of little avail in wet soils. It will be time and

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money thrown away to plant such soils in legumes, especially in the clovers, vetches, alfalfa, etc.

In addition to drainage, the land should be well supplied with humus, phosphoric acid, and potash. With these and a soil free from acidity, and inoculation with the bacteria peculiar to the legume to be planted, one can feel assured his efforts in growing these crops will be successful.

Red Clover.

The common Red Clover (Trifolium Pratense) has been grown in the Piedmont sections of North Carolina for a great many years. No man knows when it was first introduced into the State. It may have come to us from Europe with the early settlers. It has probably spread from Europe and Asia to all parts of the world where it is possible to grow it. Its worth as a forage plant and as a soil improver has been known for ages. Fig. 6 gives a good idea of a thrifty young plant. Red Clover is considered a perennial, though it often does not last over two years before it has to be reseeded. Usually if the second crop is plowed under it will reseed itself, though there have been instances when the second crop did not contain the necessary seed and seed had to be sowed to keep up the crop. Where it grows successfully it is considered the principal legume crop both for hay and for soil improvement. It wants a deep, fertile, well drained soil and free from acidity. It does not do well on poorly drained land.

Red Clover Seed.

Good seed, free from dodder and other objectionable seeds are necessary for a good stand of clover. The seed should be plump and of a bright color, indicating seed of strong vitality. If clover is grown in the neighborhood in sufficient quantity to save seed, it will be better to get seed from that source than from some unknown source. You can inspect the home grown crop and see if it is free from dooder, but you can know nothing about the conditions surrounding seed bought from a distance. But in buying seed always buy the best obtainable and guaranteed to comply with the seed law of the State. When received draw a sample and mail them to the State Department of Agriculture for examination. If they show objectionable seed in any appreciable quantity, return them to the party from whom you purchased them. It is the height of folly to buy cheap worthless clover seed. Cheap seed frequently contain a very large per cent of objectionable seeds, such as Wild Mustard, Dodder, Buckhorn, Plantain, Ragweed, Wild Chicory, Wild Carrot, Lambsquarter, Dock, and other objectionable seeds.

Time of Sowing Clover.

Red Clover is usually sown in the early spring on wheat, at the rate of 12 pounds per acre and sometimes harrowed in with a tooth or peg harrow. This harrowing is usually helpful to the wheat and also covers the clover seed. The best clover growers of the locality will know the proper time for putting in the seed. It can also be sowed in the fall, say in September, or early enough to get sufficient growth

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to prevent winter killing. By sowing in the fall, and especially if sown alone, a crop can be cut the next summer, whereas if sown in the spring it will be the following year before it can be cut for hay.

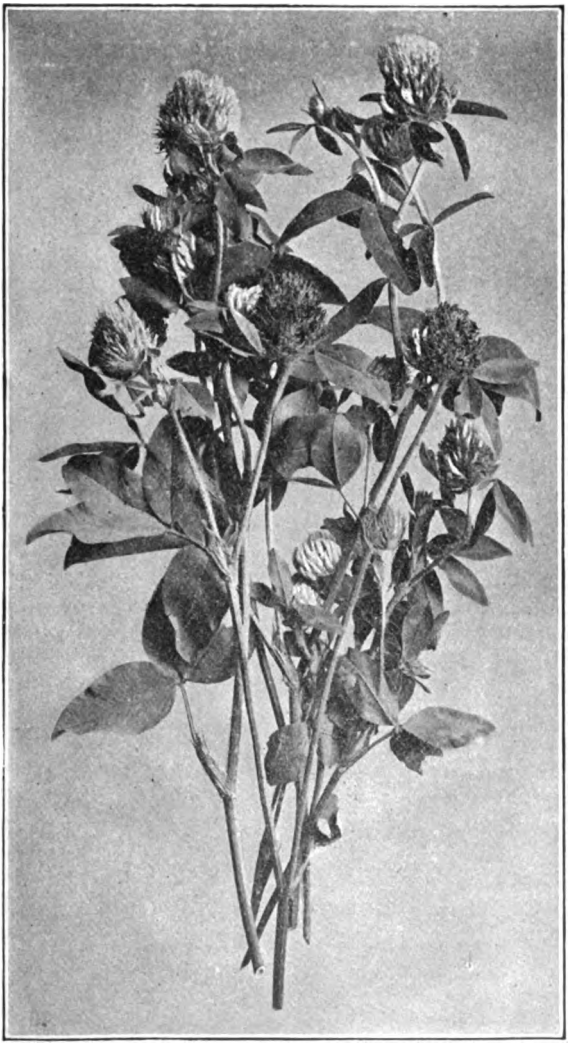

FIG. 5.—Stems of red clover in different stages of bloom.
U. S. Bulletin No. 455.

Fertilizer for Clover.

If the land is not fertile it will be well to make an application of Bone and Potash, analyzing about 12-5 at the rate of 300 to 500 pounds per acre. This should be applied at the time of sowing the clover seed, but never mix the seed with the fertilizer and sow them in that way,

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and more especially if the seed have been inoculated with culture. The least bit of fertilizer may kill the bacteria upon the seed. In fact, I doubt the advisability of mixing clover seed with fertilizers even if

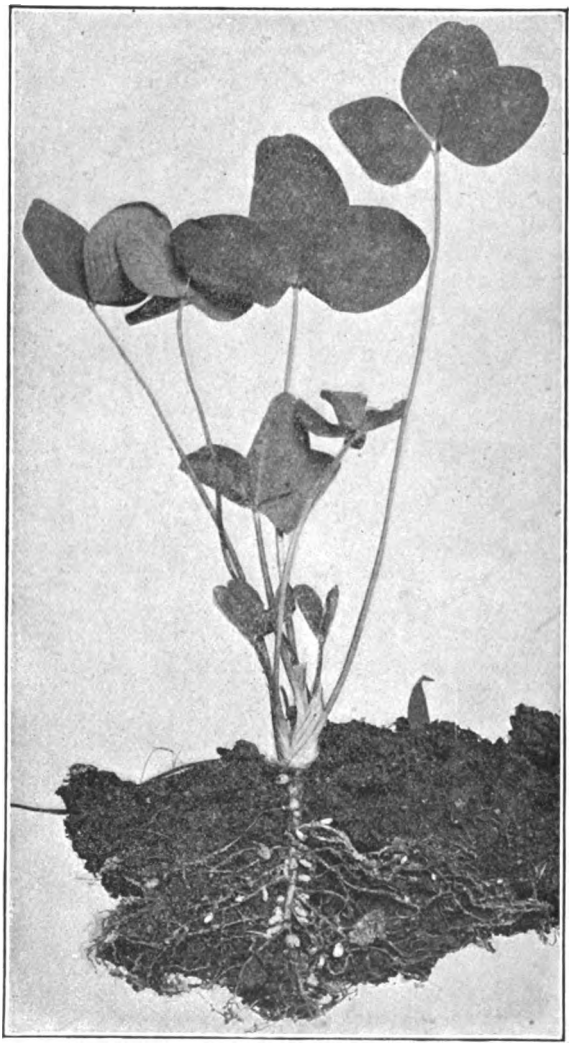

FIG. 6.—Young red clover plant showing tubercles on roots.
U. S. Bulletin No. 455.

they have not been treated with the nitrogen culture. The strong fertilizer coming in contract with the very tender clover roots or the germ may so affect the plant that it will be destroyed or if it shall come up at all it may be a weakling that will never amount to anything.

If it is not known that the land will grow clover well, it may be well

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to give it an application of lime or ashes before sowing the seed. The lime or ashes should be harrowed into the soil well before sowing the seed. A top dressing of stable manure during the winter will be very helpful to the clover. This should be applied very evenly and without clods or lumps to smother the clover plants. A manure spreader is very desirable for this purpose. For the effects of such top dressing see Fig. 7.

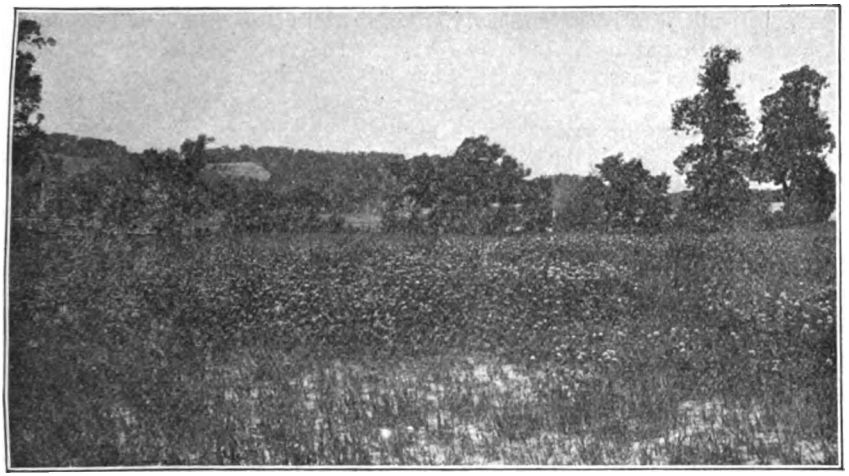

FIG. 7.—Red clover field, showing the effect of top-dressing with manure. The area in the immediate foreground received no manure; the area immediately behind received a light application, resulting in a very vigorous stand of clover.

U. S. Bulletin No. 455.

Sowing Seed.

Whenever possible the seed should be sowed when there is sufficient moisture in the soil to cause germination. The seed may be covered from one to one and a half inches. If dry weather is anticipated, it will be advisable to give them the deeper covering.

If Red Clover has not grown on the land for several years, it will be well to inoculate the seed as advised under the head "Inoculation." Absence of bacteria in the soil has been the cause of many failures in growing clover.

Where clover is sown with wheat in the spring, it will be well to run a mower over it if weeds become troublesome after the wheat has been cut; but the cutter bar of the mower should be raised so as to cut the weeds and not materially interfere with the clover. A slight clipping of the tops of the clover will do no injury, but to cut it low might destroy the stand.

Clover Hay.

The usual time of cutting red clover for hay is just after it is past full bloom, or the heads just beginning to turn brown. When cut before it is in full bloom it is quite sappy and harder to cure, though the

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hay may be of better quality for milk cattle than that which is cut later.

In saving clover hay due regard should be had for saving all the leaves. The leaves are the richest part of the plant and every effort possible should be made to save them.

Begin cutting after the dew is off and cut until two o'clock p. m. Then begin to rake into windrows and finish before the cut clover begins to get damp from the dew in the afternoon. The next day, after dew is off, put into cocks and let it remain there for a day or two until dry enough to put in a stack or in the barn.

It should dry in the shade as much as possible.

When red clover is sown for purely hay purposes, it is well to sow it with a mixture of grasses, such as will be ready to cut at the same time the clover should be cut. For this purpose Orchard Grass, Red Top, or Herds Grass, Tall meadow oat grass and Alsike clover. Timothy comes into bloom too late for red clover and should be avoided as a mixture for that plant.

Mammoth Clover.

Mammoth Clover is also known as Sapling Clover and Peavine Clover. It seems to be a large variety of the common red clover and the treatment in all respects is the same as for red clover, except that it ripens later and Timothy fits in with it for hay. Mammoth clover on account of its lateness does not have as large second crop as red clover has. Therefore the second, or aftermath as some call it, does not usually mature seed in Mammoth clover. Consequently it has to be reseeded unless the first crop is allowed to stand and make seed.

On thin land Mammoth clover seems to do better than the common red clover, but on rich lands it often grows too coarse to make the best quality hay.

Dodder in Clover.

One of the greatest enemies to clover is dodder or love vine as it is often locally known. It is a pest that should be strictly avoided. If in testing the clover seed dodder is found, refuse to sow them. But if after every care is taken some shall appear, eradicate it at once by cutting the stalks of clover close to the ground and take out every piece that has dodder on it and burn it. If the field is badly infested, plow it under and plant the field to some crop requiring cultivation for two or three years so as to get rid of the dodder.

White Clover.

White clover is well known by our farmers, therefore no minute description is necessary for that plant in this BULLETIN.

It makes a fine pasture and is also a good honey plant. It can well go into a mixture for a permanent pasture.

Alsike Clover.

Alsike clover, as it becomes better known, gains in popularity. By some it is supposed to be a cross between red clover and white clover, but best authorities seem to regard it as a distinct clover, (Trifolium

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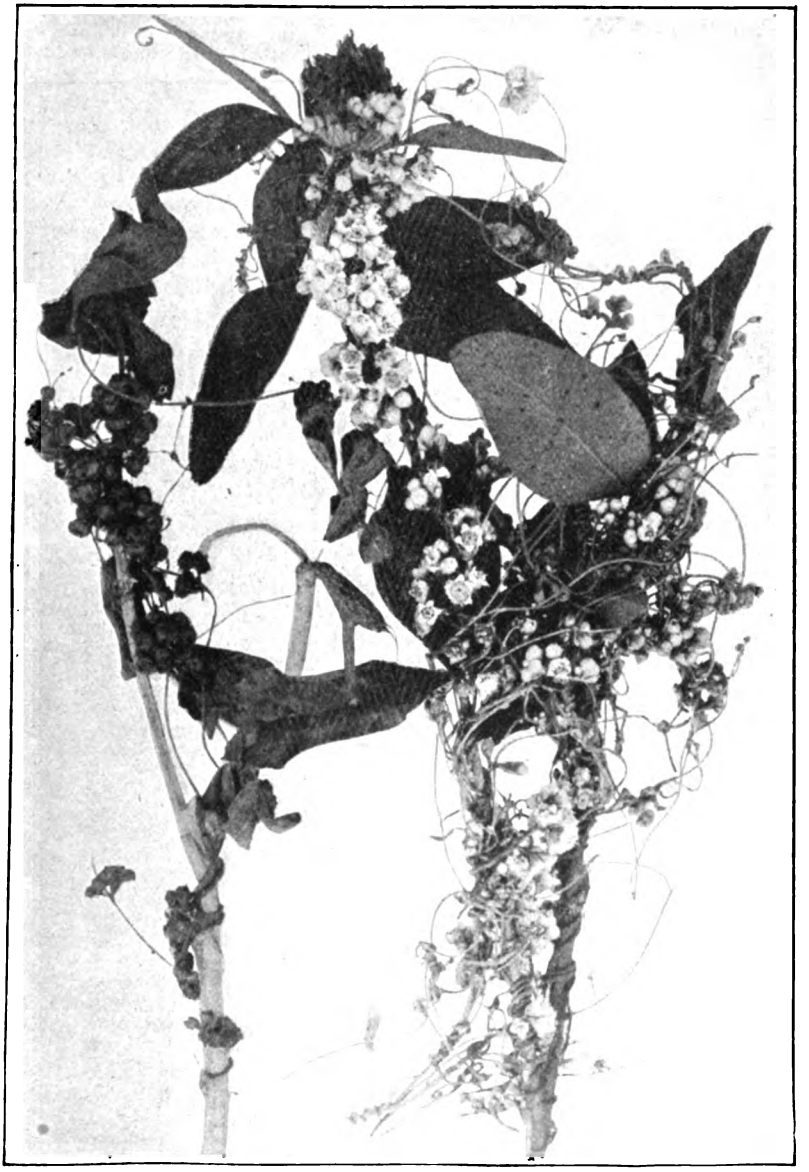

FIG. 8.—Field dodder on stems of red clover. At the right the dodder is shown in flower; at the left, in the mature or seed-producing stage.

U. S. Bulletin No. 455.

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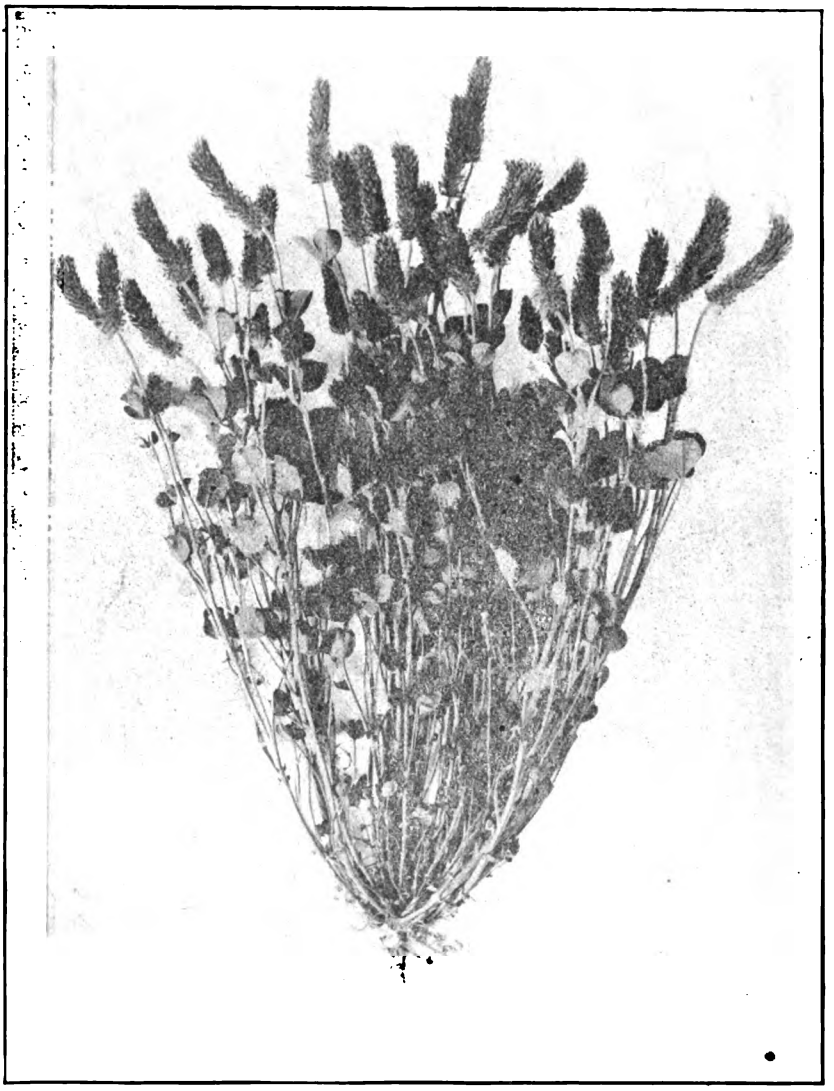

FIG. 9.—A single plant of crimson clover.
U. S. Bulletin No. 550.

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hybridum). Be that as it may, it requires about the same treatment as red clover. It makes good hay, good pasturage and is a good honey plant, especially for Italian bees. It will thrive on land too wet for red clover.

Crimson Clover.

With the possible exception of Japan clover, there is no clover that will succeed on a wider territory in North Carolina than crimson clover will. It is also known as Annual Clover, German Clover, Scarlet Clover, and possibly some other names. Interest is increasing in this crop in every section of the State. The indications are that there will be several thousand more acres in crimson clover in this State this year than was ever grown before. It can be used (1) as a soil improver; (2) as a hay crop; (3) as a winter cover crop; (4) for early spring grazing. It is an annual, making its growth in late fall, winter and early spring. It will mature and come off in time to grow a crop of corn east of the mountains; while west of the mounatins it will grow to

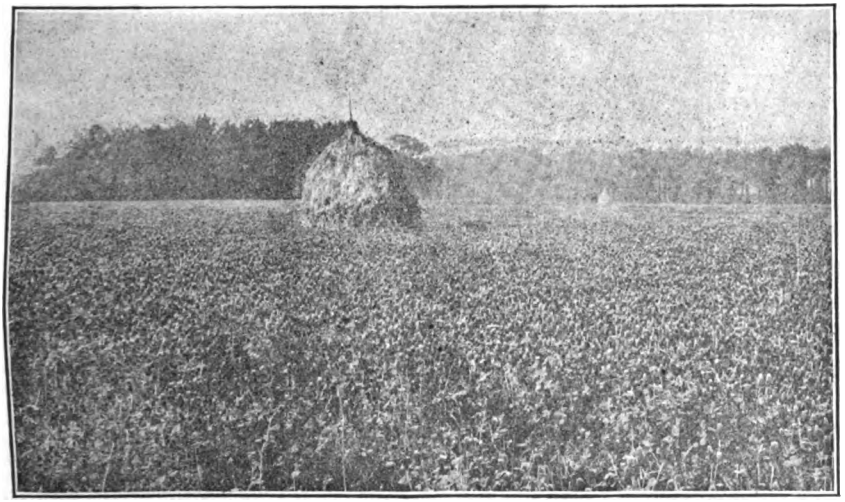

FIG. 10.—Crimson clover in an old cornfield. The clover was seeded in the corn at the last cultivation. A fodder stack is to be observed in the middle foreground. The cornstalks have been removed to avoid difficulty in mowing the clover.

U. S. Bulletin No. 550.

sufficient size to be plowed under in time to plant a crop of corn. In the cotton section it will make growth enough before time to break land for cotton to justify growing it. It will grow in soils of proper conditions from white sand to heavy clay, though it will do best on a fertile soil, well drained and limed. The writer has seen crimson clover grow on almost pure sand where lime had been applied and there was some humus in the soil. Drainage, lime and inoculation will make it grow in almost any part of the State. While it grows best on fertile soils, farmers will realize most benefit from it on thinner soils as the bacteria are more active in a thin soil than in a very fertile soil. Ino-

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culation is one of the essentials in growing crimson clover. Soil from a clover field usually gives better results than the cultures, though the latter if used according to directions and the seed sown immediately after being treated, and on a cloudy day or very late in the afternoon usually gives good results.

Crimson Clover Hay.

If the crop is intended for hay it should be cut just as it gets in full bloom. Do not wait for the bloom to commence to dry up as there

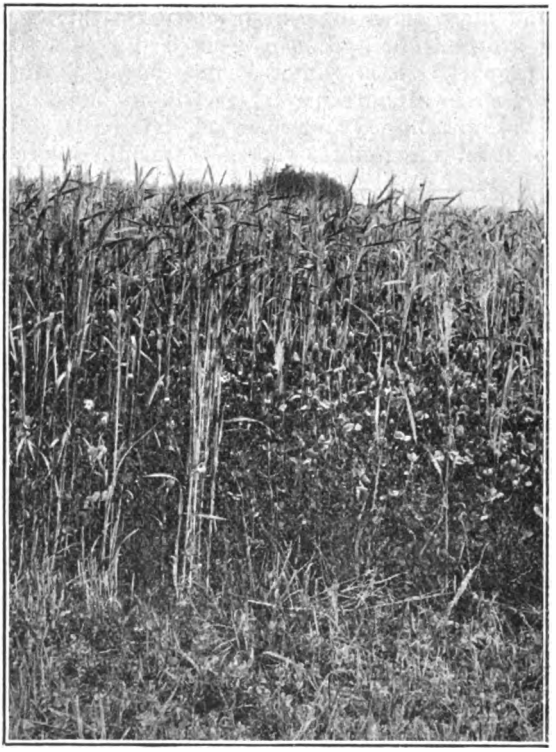

FIG. 11.—Crimson clover and wheat in mixture. In the foreground the crop has been cut and fed green to stock. The remainder was cut the next day for hay. The grain prevents the crimson clover from lodging.

U. S. Bulletin No. 550.

will be danger in feeding the hay to horses if cut at that stage. The seeds form in a rough shuck or covering and when these are dry will form into balls in the horse's stomach or intestines and may cause death. Cut at the proper time it makes a fine and nutritious hay.

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Time of Seeding.

Crimson clover can be sown in growing crops or on land especially prepared for the crop. In the latter event the land should be plowed sufficiently long before time to sow the clover to allow it to receive two or three rains so as to settle it. When sown in corn it should be sowed at the last working of the corn in the mountainous part of the State, while in the eastern part or cotton belt it will be better to not sow it until September. In sowing in standing cotton it is best to sow it immediately after the pickers and then cultivate in with a five tooth cultivator or some kind of a harrow. The seed should be covered from a half inch to an inch deep. Some claim to have had good success in sowing the seed in cotton and not covering with a harrow or other implement. This I consider hazardous unless a spell of wet weather follows. The writer has tried the plan and never secured a stand with that practice. It is also much better to sow the seed when there is a season in the land. To sow them in dry hot soil unless rain follows soon often proves disastrous. The crop is too valuable to slight and fail to get a stand.

Sowing Seed.

When crimson clover is sown alone apply 15 to 20 pounds of clean seed per acre, or three times as many by weight when they are sowed in the shuck or in the rough. If to be sown with wheat, rye or oats, sow ten pounds of crimson clover and one bushel of wheat per acre or the same when sown with rye or oats. I have seen fine results where turnip seed and crimson clover were sown together. In that event the turnips should not be sowed as thickly as if no clover was sown with them. The turnips are taken out for use in the winter and early spring and the clover then takes possession of the land.

As a soil improver crimson clover stands very high. I have known the yield of corn doubled in one season when a good crop of crimson clover was plowed under. Know a field that has in three years gained from 15 bushels per acre to 40 bushels. Only crimson clover and 16 per cent acid phosphate was used on the field.

Mr. C. L. Goodrich of the U. S. Department of Agriculture says: "I have a small farm up in Maryland. When bought in 1904 it had on it a crop of corn which produced 8 bushels per acre. In 1908 I took from it an average of 60 bushels per acre. At the start I tried to sow crimson clover, but the land was too poor, so I worked awhile with cow peas, bought some stable manure and put it under cantaloupes, following them with Irish potatoes, using commercial fertilizers. I then succeeded in getting a stand of crimson clover, which was plowed under for corn. The first crop of corn after this cover gave 60 bushels per acre without any fertilizer. This was repeated again next year, a second crop of crimson clover having been turned under. Then we had some very dry summers, and I could not get a catch of crimson clover, and had to rely on commercial fertilizer, with the result that crop yields ran down. Last year I got a good stand of crimson clover, which was turned under this spring for corn, and my crop bids fair to be as high as 80 bushels on some parts, with an average of not less than 60. I believe that

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where crimson clover will grow, it is the best manure to put under the corn crop."

I regard crimson clover a very fine crop to turn under for cotton,

FIG. 12.—A crimson-clover failure on ground too poor in humus.
U. S. Bulletin No. 550.

though it must be turned under much earlier for cotton than is necessary for corn. For cotton it should be turned under at least two weeks before the cotton is to be planted, and possibly three weeks might be better. If the clover is only 6 inches high when turned under it will do a great deal of good.

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Bur or Spotted Clover.

Bur clover (Medicago maculata) is another of the legumes that should receive more attention at the hands of our farmers than it is

FIG. 13.—Bur clover stem, showing leaf, bur and flower development.

now receiving. Especially is this true of the eastern and sandy soils of the State where it seems to do better than on heavier soils in more elevated districts. Bur clover is an annual, but where permitted to

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mature seed readily reseeds itself. In fact, there is a field of bur clover at the Edgecombe Test Farm which has reseeded itself for the past ten years.

Bur clover's chief value is as a soil improver, though it can be made into hay, but the quality does not compare with hay made from the other clovers.

From the July, 1904, BULLETIN, issued by the North Carolina State Board of Agriculture, I find the following concerning this plant:

"Bur clover (Medicago maculata, Sibth). Annual, much branched, 15 to 60 branches at the base, ascending and spreading, smooth; stems 15 to 30 inches long. Leaves petioled, three-parted; leaflets broad at the apex, pointed at the base, emarginate, cuneate, wavy margin, 3-8 by 1-2 inch; stiples, small, dentate. Flowers yellow, 1-8 inch long, in small heads of two to four. Pods 1-4 by 3-4 inch, spirally twisted in two to four coils; coils flat, veined, each provided with two rows of reflex prickles. Seeds three to five to the pod, 1-8 to 3-16 inch long, strongly kidney-shaped, deep yellow in color. Nitrogen tubercles forked, rather flattened, 1-8 to 1-2 inch in diameter. Native of Europe and Asia, supposed to have been introduced into America in ship ballast.

"The two illustrations (Nos. 13 and 14), and the printed matter give a fair idea of the growth and habits of bur clover. When the stand is thin single plants occupy considerable space, varing from 2 1/2 to more than 4 feet square. On plants of ordinary size we have found 40 or more stems, with 60 or more burs, each bur bearing 3 to 7 seed, usually 5. On this basis a single plant would have 2,400 burs and 12,000 seed.

Inoculation of Soil for Bur Clover.

"To grow bur clover successfully on a soil that has never grown this legume, it is generally unnecessary to resort to artificial inoculation, as the burs containing the seed after maturity fall to the ground and have to be swept up, hence enough germs will be contained in the soil that clings to the burs to insure tolerably complete inoculation when they are sown. On an uninfected piece of land, certainly the inoculation will be completed by the beginning of the second year.

Bur Clover for Soil Improvement.

"As shown in Table 1, bur clover, as an average of two years' experiments—1903 and 1904—has produced on the fine sandy loam soil of the Edgecombe Test Farm 2.91 tons of hay per acre, the fertilizing constituents of which, at the prices assigned them in mixed fertilizers this year, are worth $36.24 per acre. Of this amount $28.27, or 78 per cent, is due to the nitrogen it contains, which was gathered principally, as with vetch, from the air through the instrumentality of bacteria inhabiting the nodules on the roots of the plants. With this legume 87.2 per cent of the total nitrogen and 89.5 per cent of the total fertilizing constitutents are contained in the stems, leaves, leaf-stalks, burs, seeds, etc. This leaves in the soil, after removing the tops, 12.8 per cent of the total nitrogen and 10.6 per cent of the total fertilizing constituents of the entire crop as roots and stubble.

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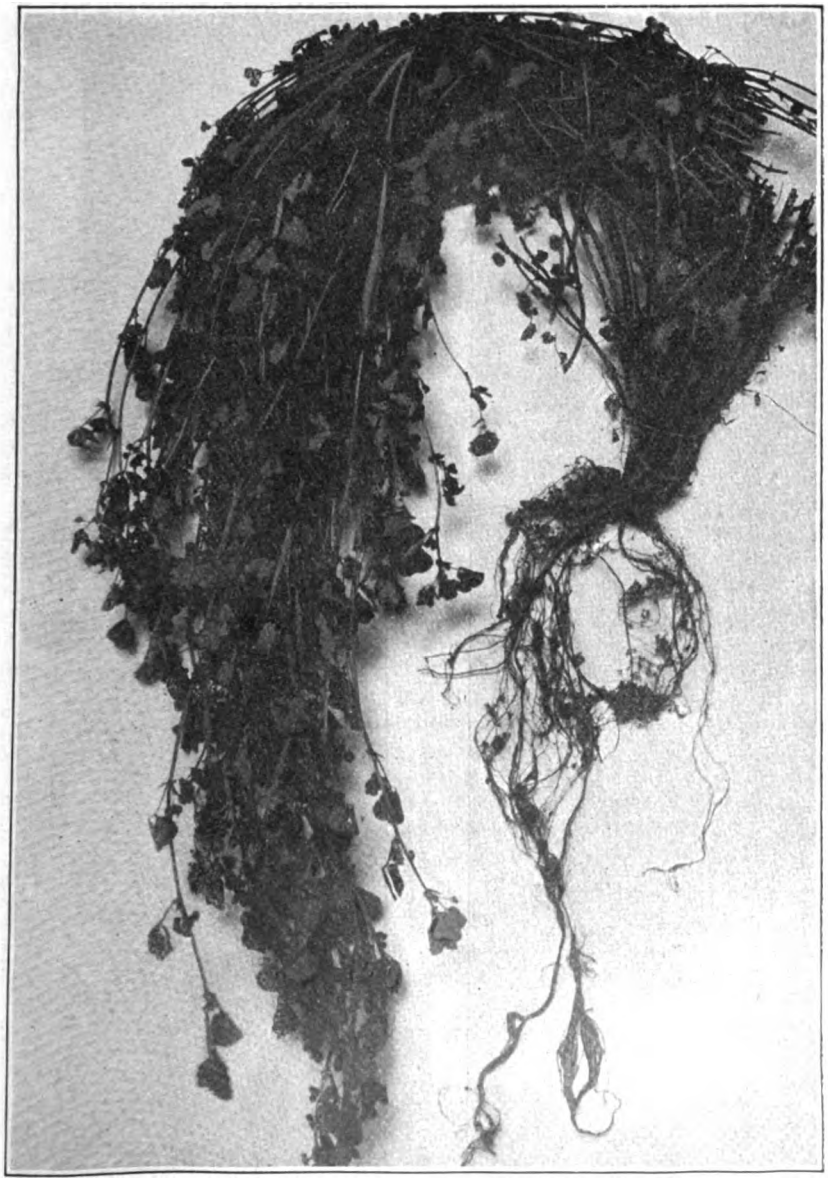

FIG. 14.—Bur clover plant, Edgecombe Test Farm, May 12, 1903.

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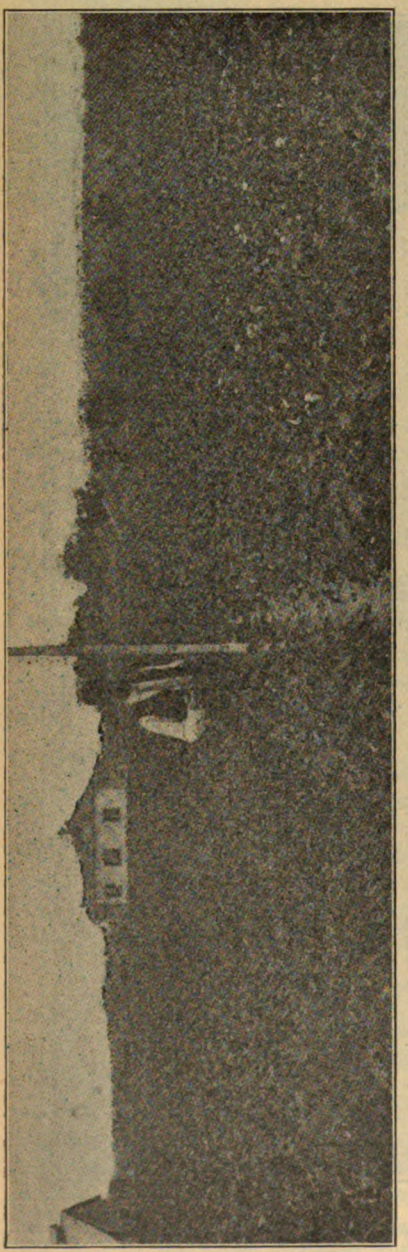

FIG. 15.—Cotton after bur clover, fertilized with acid phosphate and kainit only (K. P.). Yield per acre, 1,620 pounds seed cotton.

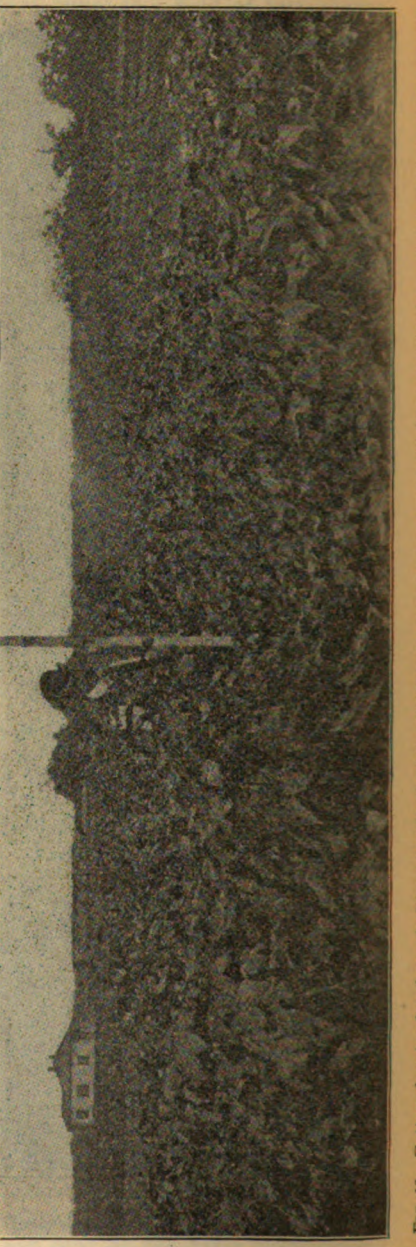

FIG. 16.—Cotton close to plot shown in Fig. 8, fertilized with acid phosphate and cotton-seed meal (N. P. K.). Yield per acre, 1,230 pounds seed cotton.

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"In Fig. 15 is shown cotton following a crop of volunteer bur clover and fertilized with 28 pounds of phosphoric acid (200 pounds 14 per cent acid phosphate) and 10 pounds of potash (80 pounds kainit) per acre in the form of acid phosphate and kainit, while Fig. 16 shows cotton following cotton and fertilized with 200 pounds of acid phosphate, 80 pounds of kainit and 120 pounds of cotton-seed meal. In other words, Fig. 15 shows cotton to which the nitrogen was supplied by a previous crop of bur clover, and Fig. 16 cotton to which a complete fertilizer had been added. The plat on which bur clover supplied the nitrogen yielded 1,620 pounds of seed cotton per acre, which was exactly 400 pounds in excess of the plat receiving an application of a complete fertilizer. This 400 pounds of seed cotton sold for $18, and deducting from this $2 for picking and excess hauling, we have a gain of $16 per acre in favor of the bur clover plat. It must also be remembered that this gain was made with a commercial fertilizer containing no nitrogenous material and costing 46 per cent less than that applied to the plat (Fig. 16) receiving a normal application of fertilizer. The more luxurious growth of the cotton following bur clover is readily seen by comparing the growth in Fig 15 with that in Fig. 16. On the bur clover plat the cotton averaged from 3 1/2 to 4 1/2 feet high, while in the plat receiving a normal fertilizer application the average height was only from 2 to 3 1/2 feet.

"Fig. 17 shows a very productive growth of corn after a crop of bur clover in 1903. Almost every stalk bore two or more well developed ears per stalk. The corn was planted after a crop of bur clover seed had been harvested. The seed left on the ground reseeded the land, which produced a good volunteer growth of clover in 1904.

"We can more fully appreciate the value of this plant as a soil improver when we see from Table 1, as an average of two crops on the Edgecombe farm, that the entire plants on one acre contained 162.1 pounds of nitrogen. It would require 2,456 pounds of cotton-seed meal, containing 8 per cent ammonia, to furnish this quantity of nitrogen, which was obtained largely from the air by the clover.

Bur Clover for Pasturage.

"In addition to its value as a soil improver, bur clover is an excellent grazing crop. When sown in corn or cotton at the last cultivation in July or August, it comes up in time to give some grazing in the fall. As soon as spring opens the clover puts out rapidly, sooner than most other plants, and gives good grazing from the first of March, often in February, and up to the first of April, when it is well to remove stock and give an opportunity to produce seed and tops for soil improvement. Calves, sheep and hogs grazed our crop on the Edgecombe Test Farm until the first of April this year. By the 20th of May it had reached a height of 2 1/2 feet, producing air-dried hay at the rate of over 3 1/2 tons per acre. The average yield for two years has been 2.9 tons per acre. This shows how rapidly it makes its growth. Stock do not like it well at first, but as there is but little green material to be had in the winter and spring, they soon become accustomed to it and graze it readily. It is a specially good grazing crop for hogs, sheep and cattle.

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FIG. 17.—Corn after bur clover, 1908, Edgecombe Test Farm.

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TABLE I.—WEIGHT, COMPOSITION AND FERTILIZING VALUE OF AIR-DRIED BUR CLOVER

LEGUME.	Weight of Air-dried Crop in Pounds per Acre.	PERCENTAGE COMPOSITION.				WEIGHT IN POUNDS OF FERTILIZING CONSTITUENTS PER ACRE.			VALUE OF FERTILIZING CONSTITUENTS PER ACRE.			Total Value Fertilizing Constituents.
		Moisture.	Phospho-ric Acid.	Potash.	Nitrogen.	Phospho-ric Acid.	Potash.	Nitrogen.	Phospho-ric Acid.	Potash.	Nitrogen.	
1903.												
Bur Clover, stems, leaves, burs and blooms.	4,396	8.70	.42	2.69	2.02	18.46	118.25	88.80	$ .83	$ 6.50	$ 17.76	$ 25.09
Bur Clover, roots and 2-inch stubble.....	704	6.79	.54	1.04	1.86	3.80	7.32	13.09	.17	.40	2.62	3.19
Total.....	5,100	.....	.....	.....	.....	22.26	125.57	101.89	1.00	6.90	20.38	28.28
1904.												
Bur Clover, stems, leaves, burs and blooms.	7,288	8.75	.60	1.66	2.66	43.73	120.98	193.86	1.97	6.65	38.77	47.39
Bur Clover, roots and 2-inch stubble.....	1,558	7.07	.44	.64	1.83	6.86	9.97	28.51	.31	.55	5.70	6.56
Total.....	8,846	.....	.....	.....	.....	50.59	130.95	222.37	2.28	7.20	44.47	53.95
Average for two years, stems, etc.....	5,842	8.73	.51	2.18	2.34	31.10	119.62	141.33	1.40	6.58	28.27	36.24
Average for two years, roots, etc.....	1,131	6.93	.49	.84	1.85	5.33	8.65	20.80	.24	.48	4.16	4.88

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Where it is only desired to have enough seed produced to reseed the clover, it may be grazed until the middle of May or even later. In fact, its running habit makes it almost impossible to graze it so closely as to prevent its producing enough seed to reseed itself.

"It grows well on Bermuda sod and in connection with it it will give almost continuous pasturage, as the Bermuda comes up early in May, about the time the clover is giving out, and continues until frost, when the clover is beginning to furnish grazing. To start the clover on Bermuda sod broadcast the seed and scarify the sod, so as to cover them lightly.

"Because of the ease with which bur clover reseeds itself, its value as a soil improver and grazing crop, and the readiness with which it fits into rotation with cotton and corn, makes it a most valuable crop for growth in connection with cotton and corn farming. Both cotton and corn may follow bur clover without the trouble or expense of re-seeding the clover.

Soil.

"Our experiments with bur clover have been mainly on the sandy soils of the eastern part of the State, where for the past two years it has made a most excellent growth, reseeding itself after the first sowing. It does best on the heavier types of sandy soil which are underlaid by clay subsoil, and which are generally moist, but it grows well on the lighter types of sandy soil, and will, we think, after the first year, make a satisfactory growth on most eastern soils where the drainage is fairly good. A small area has been grown one year on the clay land in the Piedmont section of the State with fairly good results, and it seems likely that it will succeed in that portion also. In the States to the south of us, it grows well on moderately stiff prairie land, which would indicate that it will likely succeed on most of the soils of this State, where the climatic conditions are favorable.

"We are making experiments with it in different sections of the State, with a view of obtaining information on this point.

Preparation of Soil and Seeding.

Where this clover is to be sown by itself the land may be prepared as for grain or grass crops. Our experience has been mainly broadcasting the seed in corn and cotton and covering them at the last cultivation of these crops, the latter part of July or early in August. This is done by the use of cultivators, which only cover the seed one to two inches deep. This method would likely not work so well where ridge culture is followed and the turning plow is used for "laying by" the crop, as the seed would likely be covered too deeply by this method. The seed may be sown as late as the middle of September, but seeding should not be delayed beyond this, as it requires considerable time for the burs containing the seed to become sufficiently moist for the seed to germinate. When planted this late seed may be broadcasted in cotton, corn or other crops, and then worked in lightly with harrow or cultivator, using a short single-tree to prevent injury to crops in narrow rows. Two bushels of seed will give a fair stand the first year (four

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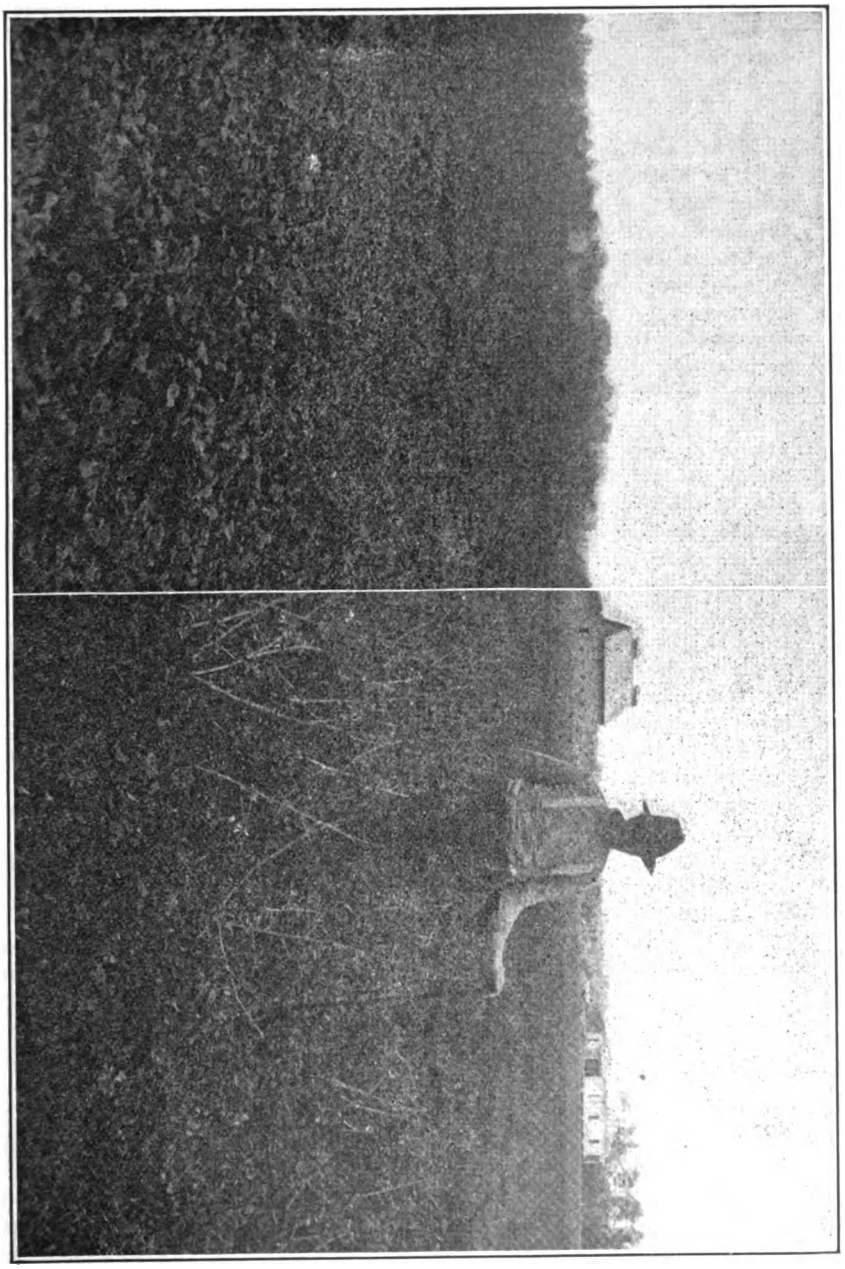

FIG. 18.—Bur clover after cotton, clover 15 inches high, April 15, 1903.

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bushels will give better results), after which it will not be necessary to reseed if the crop is given proper treatment and an opportunity to mature seed, as referred to under "Reseeding".

Reseeding.

"*When Grown in Rotation with Corn.*—Bur clover will mature enough seed by about the 20th of May to thoroughly reseed the field for another year. As soon as sufficient seed have matured for reseeding and the season will permit, the land on which the clover is growing should be broken thoroughly with a two-horse plow and then run over with a cutaway harrow. The corn rows should be run from four to five feet apart and a fertilizer application of a mixture of 200 pounds of acid phosphate, 100 pouuds of kainit applied in the drill when the corn is planted. By this method it will be possible to get the corn in the ground early in June, which has been found the best time on the fine sandy loam soil of the Edgecombe Test Farm, especially when fertilizers are to be used. The corn should be reduced to a stand of 18 or 20 inches on medium land. As it will require few cultivations, the entire cost of the corn crop for fertilizer and labor, up to time of harvesting, should not exceed $4.50 per acre, and a crop of from 20 to 60 bushels of shelled corn per acre should be expected on fairly good land with an average good season. Fig. 11 shows corn which was treated in this way.

Excellent results have also been obtained by running off the corn rows in the bur clover field during March, April or early May, and applying the fertilizer in this furrow. Then two furrows are thrown on the fertilizer with turning plow and after allowing to stand awhile the corn is planted in the usual way. This will leave between the corn rows a middle some two feet wide of growing clover. Now, without disturbing this middle, the corn is cultivated one or more times with a suitable plow or cultivator before the seed of the bur clover have matured. As soon as the seed are ripe the middle is broken out by means of a one-horse turning plow, followed shortly by cultivation with a Plant Jr. cultivator, which should level down and pulverize pretty thoroughly the land between the rows. This will ordinarily conclude the cultivation for corn. Bur clover when treated as indicated above will mature enough seed to be assured of a good stand the following fall and spring.

Bur Clover as a Cover Crop and Soil Protector.

"From what has preceded it will be readily seen that bur clover has special advantages as a cover crop for orchards and other places where protection is needed in fall, winter and early spring. It is during these parts of the year that our lands are most exposed to washing from the surface and the loss of plant-food from leaching. The clover will prevent this to a large extent, at least, by appropriating the plant-food as it becomes available and then after the clover dies down in the spring will leave the plant-food it took from the soil and collected from the air in the land for the use of succeeding crops. After it has matured seed, other crops may follow; orchards may be cultivated and later planted in peas, in case it is desired. This procedure will enrich the land very rapidly and at small cost. Liberal applications of acid phos-

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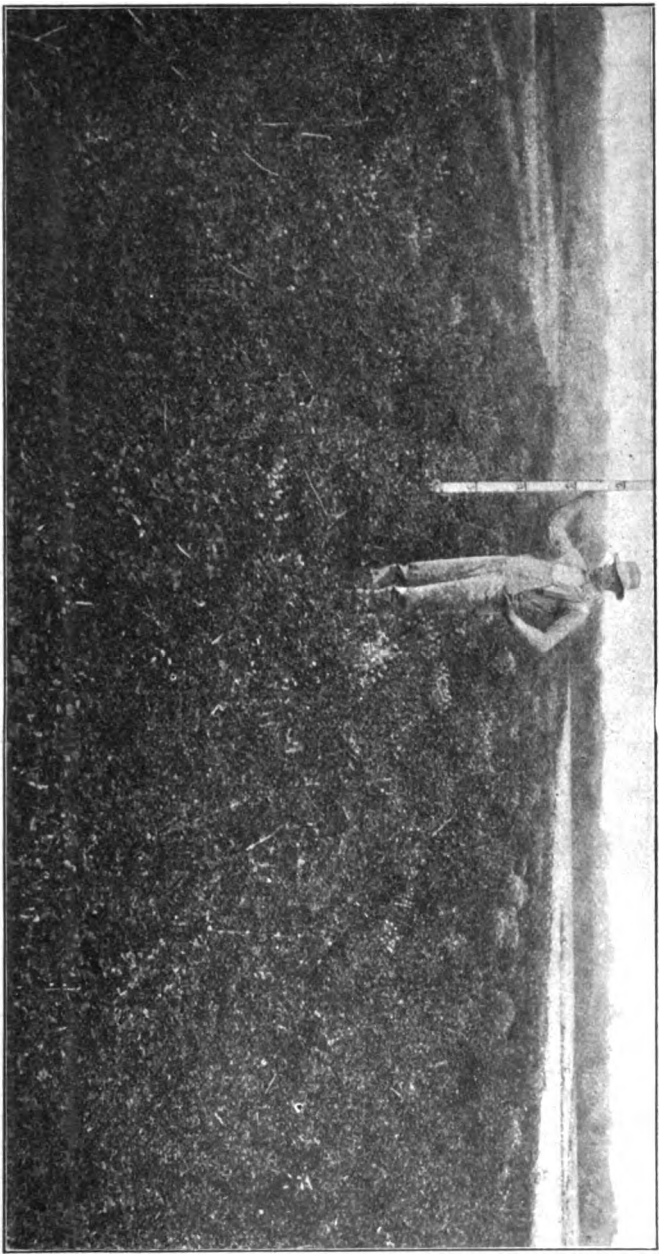

FIG. 19.—Bur clover after cotton on sandy land, Edgecombe Test Farm, May 12, 1903.

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phate and potash salts should be used in connection with soil improvement with bur clover and cow peas. It is not intended to suggest that bur clover will take the place of cowpeas, but rather to supplement the

FIG. 20.—Sweet-clover plant near the end of the second season's growth. U. S. Bulletin No. 485.

work of the latter, the growing season of which begins about the time the clover has finished its mission. They fit into each other therefore nicely, and can be grown to the greatest advantage in connection with general and many kinds of special farming in this State."

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Sweet Clover.

Sweet clover (Melilotus alba) is another plant that will soon be knocking at the doors of the North Carolina farmers for recognition. It is classed among the best soil improvers and also as a large yielder of hay, which if cut at the proper time makes hay of higher feeding value than red clover, though it is not liked as well by stock until they become accustomed to eating it. It grows best in limestone soils, but will thrive in almost any soil that is well drained and not too acid. It

FIG. 21.—Roots of melilotus (sweet clover) showing nodules.
U. S. Bulletin No. 485.

will make a good growth in soils too poor for either alfalfa or red clover.

This plant is a native of Asia and came to us from Europe 150 or more years ago. But it is in recent years that its value has been recognized. In Kentucky it grows along the right of railways to a height of 8 or 10 feet. It also flourishes in the limestone sections of Mississippi, Alabama and in other states. Numerous correspondents of Wallace Farmer, of De Moines, Iowa, speak in high terms of it as a hay plant and for pasturage. However, on account of its bitter taste stock do not take readily to it until they have become accustomed to it. Then, it is

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said, they eat it readily and thrive on it. It also yields large quantities of honey of a fine quality and for that reason is prized by bee keepers.

Sweet clover is a deep rooted plant and carries the same bacteria that alfalfa does, therefore it will inoculate the soil for alfalfa. By getting it started in old fields or waste land it will occupy it for years as it will reseed itself and bring it up to a state of high fertility. The seed should be sowed in late summer or early spring. The disking of the land is usually a better preparation than to give it a thorough and deep plowing. Twenty-five to thirty pounds of seed are required to seed an acre.

In sowing sweet clover, like any of the other clovers, it is well to inoculate the soil, which in North Carolina can best be done with the pure culture method. Once a person has sweet clover growing, he can use soil from that particular spot of land to inoculate other fields where he intends sowing.

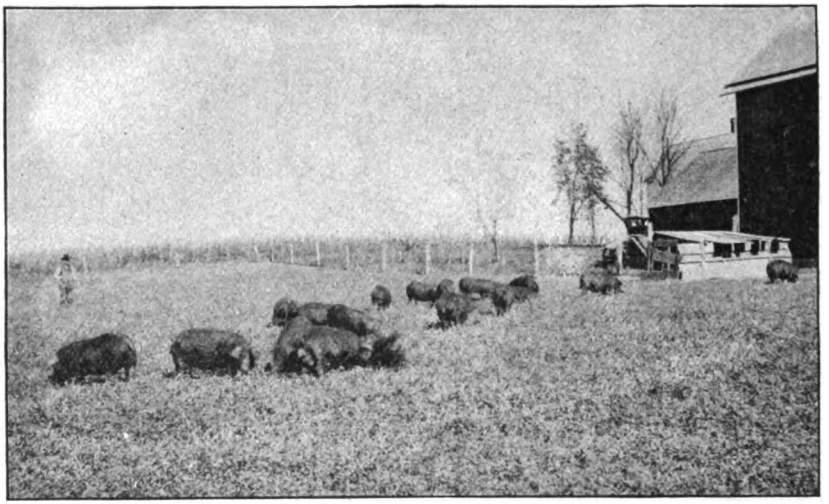

FIG. 22.—Hogs pasturing on sweet clover in Iowa in late October.
U. S. Bulletin No. 485.

Sweet clover is recommended for pasturing all kinds of live stock, but it is better to turn them on it while the clover is young and before it has acquired the very bitter taste that it has after it has become older. By the time it is grown they will have acquired a taste for it and will eat it readily.

For a full treatise on this plant get Farmers Bulletin No. 485 from the U. S. Department of Agriculture, Washington, D. C.

Lespedeza or Japan Clover.

Japan clover (Lespedeza striata) is said to be a native of eastern Asia, probably Japan, as its name indicates. So far as I know it was introduced into this State during or right after the Civil War. Many

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think it was brought into the State with Sherman's army, probably in the hay fed to their cavalry and other horses. Since its introduction it has practically spread all over the State. I have seen it growing from the sea coast to the mountains, and even beyond the mountains. It grows along roadsides and in fields that have not been cultivated for some time.

FIG. 23.—A plant of lespedesa, showing the upright growth made where the stand is reasonably thick. U. S. Bulletin No. 441.

Japan clover is an annual, coming up in early spring and continuing its growth until late fall. With us it usually grows from four inches to eight or ten inches in height where the land is good. On real poor land it may not grow to more than three or four inches in height. It

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is of an upright nature, and has small purple blossoms immediately above the leaves. These do not appear until summer or fall.

Japan clover is valued principally as a pasture plant, though where it grows high enough it will make good hay. In Mississippi and other of the more Southern States they often get as much as two to four tons of hay per acre. I think I have heard of as much as six tons per acre on very fertile land in the Mississippi valley.

Japan clover is highly recommended for permanent pasture as all kinds of live stock thrive on it. But when used for permanent pasture fire must be kept off of it or the clover will be entirely killed out. It readily reseeds itself where it once grows. When sowing use from 15 to 20 pounds of seed per acre and harrow in. It has the reputation of salivating stock the same as red clover will.

Alfalfa or Lucerne.

Of all the hay crops grown in the United States there is probably none that ranks as high as alfalfa, where soil and other conditions are well suited to it. This is another plant that came from Asia and was introduced first into this country from England more than a hundred years ago, but owing to a lack of knowledge of the requirements of the plant it did not spread over a very large territory when first introduced. In 1854 it is said to have been introduced into California from South America and has gradually worked its way east until it is now grown to some extent probably in every State in the Union. It is known to have grown in and around Hillsboro in this State for the last hundred years, but it has spread little from that section. The late Dr. Hogg of Raleigh sowed alfalfa in his garden, which was immediately across the street in front of the Governor's Mansion, about 25 years ago. A part of the lot was sold some years ago for building purposes and yet there is still some of the alfalfa growing on the land. There are a few fields of it near Raleigh, some of which have been giving good cuttings of it each year for the last four or five years.

Alfalfa is a very deep rooted, long lived plant. I have known the roots to go down over three feet the first year of its growth. It has the reputation of being probably the deepest rooted of all the cultivated plants we have. In the western states it is said that in making cuts for railroads through alfalfa fields it is not infrequent that the roots have been found as much as 18 or 20 feet below the surface, and in some instances much deeper than that. But in North Carolina such conditions would hardly be met.

Alfalfa is not a poor land crop. To grow it successfully it requires a fertile soil, well drained and free from acidity. The area over which we can grow it increases as we become better acquainted with its requirements, and it is also possible that the plant adapts itself to conditions surrounding it so that in a few years we will be able to grow it successfully in almost any part of the State.

The writer has grown alfalfa for several years and has not found it a difficult crop to grow. Fertile soil, drainage, lime and inoculation are the things necessary.

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Preparation of Land.

The soil should be plowed deeply several weeks before the seed are to be sown so as to let the land settle into a good firm seed bed. Lime at the rate of from 1,000 pounds per acre up to a ton of freshly burned lime according to the requirements of the soil. If ground limestone is used, twice this amount may be applied. Eight to ten tons of stable manure per acre is also desirable, but in the absence of that substitute

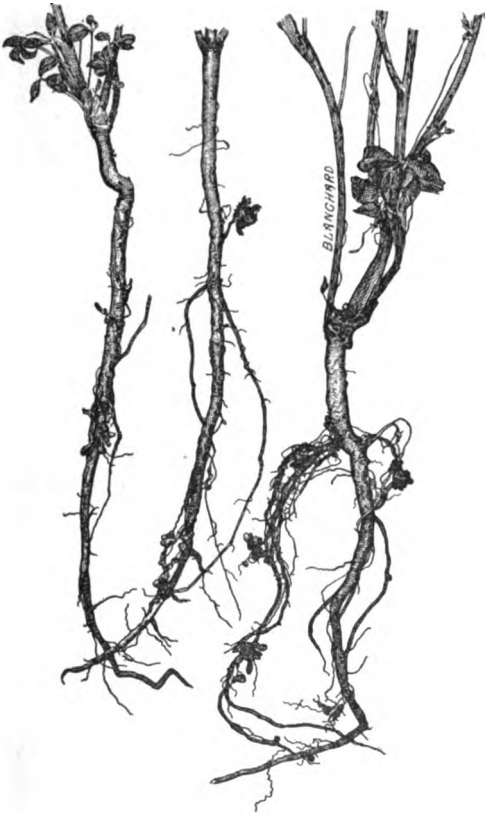

FIG. 24.—Roots of young alfalfa plants showing nodules.
U. S. Bulletin No. 214.

800 pounds of raw ground bone and 200 pounds of muriate of potash, broadcast and well harrowed in.

Seeding and Inoculation.

After the above preparations the land will be ready to seed. Usually the best time to seed in the central or eastern part of the State is about September 1st to 15th. But before seeding the field should be harrowed,

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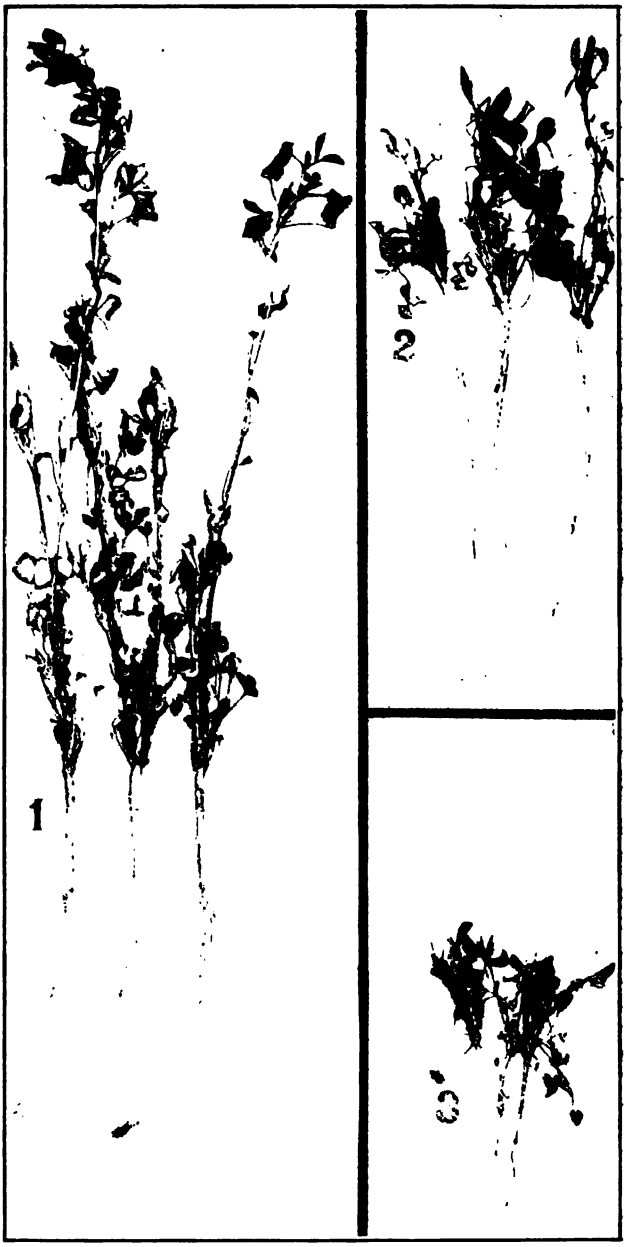

FIG. 25.—Alfalfa seedlings at the beginning of winter. 1, Seeded August 15, 13 inches high; 2, seeded September 1, 5½ inches high; 3, seeded September 15, 2¼ inches high. The larger, early-seeded plants are much better able to withstand the winter than the small, late-seeded ones.

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rolled and reharrowed until a good seed bed is formed. Either soil from a field where alfalfa is growing successfully at the rate of 500 pounds per acre, should have been applied and harrowed in, or culture should be obtained to inoculate the seed. Where one has a disk grain drill the seed could be wet and mixed with the soil and sowed out of the fertilizer attachment of the drill. Set the drill to sow from 300 to 500 pounds of soil per acre and have the seed, about 30 pounds per acre, thoroughly mixed with the soil. If no soil is available and culture is to be used, the directions accompanying the culture should be followed to the letter. In seeding it is well when sowed by hand to divide the seed and sow half of them one way and them sow the other half at right angles to the way the first was sowed. In this way there will be a more even distribution of the seed than if they were all sowed one way. This same method would also give more even distribution of the seed when sowed with a drill or with a seeder. They can be covered by a weeder or light harrow, going over the land first lengthwise and then crosswise, covering the seed from a half inch to an inch deep. If soil is of a compact nature, less than one inch of covering will prove sufficient; while if more or less open, the seed should be placed in the soil two inches. In other words, the more open the soil the deeper, other things being equal, the seed may be put with safety. Should the land on which the alfalfa is sown be of such a character as to run together and harden when dry, it will frequently be found advisable to run over the field with a light harrow to break the crust formed should a rain fall before the seed have sprouted very much, because if this is not done a large percentage of the young and tender plants will perish in their futile efforts to reach the air and sunshine. Where spring seeding is permissible or advisable, the same thorough preparation advised for fall seeding should be given for the spring seeding.

In spring seeding, sow early. A great deal is to be gained by the early sowing. For the warmer sections of the State, sow as early as the middle of March and up to the middle of April for the cooler and mountainous sections. However, spring sowing is not advisable in sections where crab-grass grows freely. In these sections it is far preferable to sow alfalfa in the fall.

Treatment First Year.

The first year is the most critical period of its life, for if the proper treatment is not given its failure will almost invariably follow, notwithstanding the fact that the young plants may have started off with every prospect of success. With early fall seeding, it is not usually best to clip before winter, as an eight or ten-inch growth is necessary to carry it through the winter and give it a good start the following spring. Ordinarily the normal mowings for hay when the alfalfa plants have gone to bloom will be sufficient to hold the weeds in check during the first year, as with a good start the preceding fall the plants will usually produce a good crop of hay by the middle of May or before the weeds have had time to prove themselves troublesome.

If at any time, however, the plants turn yellow or the weeds threaten to choke them out, it will be best to set the cutter-bar on the mower

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high, and clip the plants back to a height of three or four inches. This treatment will not only tend largely to keep the weeds and grass in subjection, but will also stimulate a stronger and more vigorous growth of the young plants as well as produce a branching of the old stems and multiplying of new stems of the same plant. If the clippings are light they may be left on the ground to protect and improve the soil.

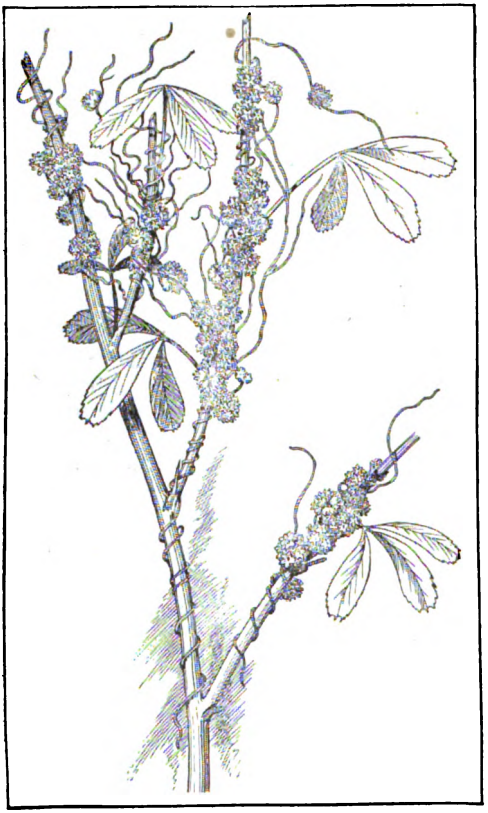

FIG. 26.—Mature dodder plant on alfalfa stem.
U. S. Bulletin No. 339.

If, however, the alfalfa continues to grow and keep green and vigorous, do not clip, but allow it to come into bloom and cut for hay. Do not wait for it to come into full bloom, but cut when from one-fourth to half the stalks show bloom. The quality of the hay from the early cutting is better than if allowed to come into full bloom. The crop can be cut from three to five times a year according to locality and seasons. It is not advisable to cut so late in the fall as to not allow a sufficient growth to protect the crowns of the plants from the cold weather. It is usually safe to not cut it after September, except in the warmer sections of the State, and there, not later than the middle of October.

After the first cutting alfalfa may be cut as often as the plant sends

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out shoots from the crown and they get about one or two inches long. This is a better criterion as to the time of cutting than the mere appearance of bloom. When these sprouts start out it is evidence that another growth has begun and the plant is ready to be cut. However, the cutting should not be done before this growth has attained as much as one or two inches in height. Then have the cutter-bar of the mower high enough to not clip this new growth.

Alfalfa Enemies.

Probably the most destructive enemy to alfalfa is dodder. Dodder is a yellow vine that comes from the dodder seed and at once takes hold of the alfalfa plant and twines around it. The vine early dies at the ground and afterward lives entirely on the alfalfa plant. Great care should be exercised to see that no dodder is allowed to get a foothold in a field of alfalfa. The first precaution is to buy only seed that are guaranteed to be free from dodder, and then if any shall appear go over the field at once and cut every alfalfa plant that has any dodder clinging to it and carefully take it out of the field and burn it. The least bit of the vine will take hold of a plant of alfalfa and go on with its work or destruction and filling the field with its seed.

Leaf Spot.

Leaf spot is also a disease that is common to alfalfa but usually does not kill the plant. It causes the leaves to become specked as though stung with some insect, turn yellow or with a red tinge and fall off. The falling off of the leaves lessens the quantity of hay and also the quality as the leaves are the most valuable part of the plant. The best and only remedy that I know for leaf spot is to cut the alfalfa and cure it for hay. The crop following may be free from the disease. It is usually worse in the late fall than in spring or summer.

Alfalfa can usually be cut from three to five times a year, yielding on good land an average of one ton per acre at each cutting. The earlier cuttings will average over a ton per acre, while the later cuttings will not average a ton per acre. In this State the crop will usually run from three to five years before it will run out, or the stand get so poor that it will not pay to keep it longer. When the stand gets thin or it dies out in spots it is time thrown away to endeavor to replant the dead spots. The best thing to do is to replow the field and sow it all over again.

Vetches.

The term vetch used in this BULLETIN refers to Hairy or Sand Vetch (vicia villosa), though there are more than a hundred species of this family, of which about fifty are annuals. Those best known to us are the Hairy Vetch, the common or Oregon vetch, the Carolina or wild vetch. The latter grows wild in nearly every part of the State and is known locally as Wild Pea, Partridge Pea, and possibly it has other names. It usually grows to about two feet in height and has quite small violet colored blossoms. It is earlier than the Hairy or common vetch and is relished by stock and makes hay of a good quality.

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FIG. 27.—Stem, flowers and seed pods of hairy vetch.

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The flowers of Hairy vetch are much larger than those of the wild vetch and are borne in clusters of 20 to 30 blue violet colored blossoms on a long slender vine or stalk. The vines or stalk grow to be from four feet to ten or twelve feet long on very fertile soil. This plant is quite hardy and succeeds in all parts of the State. It is a very fine soil improver and also makes a fine quality of hay, especially when sown with

FIG. 28.—Hairy vetch and rye growing together in Virginia.
U. S. Bulletin No. 515.

oats. It improves the quality and also increases the quantity of hay when sown with oats or wheat. Unless it is sown with some crop to hold it up, it lies so close to the ground that it would be difficult to harvest it. It is about the highest in nitrogen contents of any of our legumes, exceeding alfalfa or soy beans in this respect.

Hairy Vetch can be sown from August to November according to location. It can be put in at the last working of the corn or cotton crop

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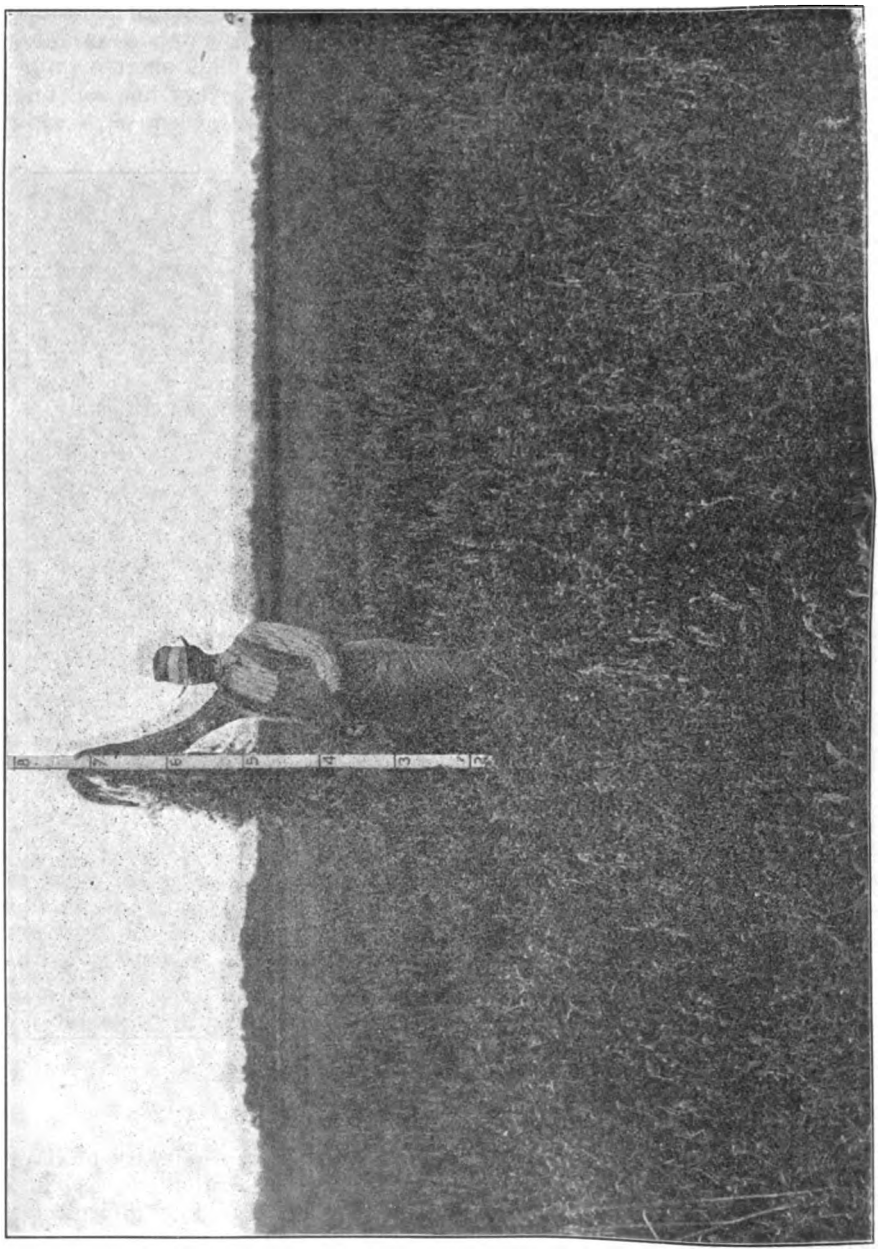

FIG. 29.—Hairy vetch (volunteer crop) after inoculation on sandy land, Edgecombe Test Farm, May 12, 1903. Yield 5,100 pounds per acre.

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or can be put in later as directed for crimson clover. When sown alone for soil improvement, sow from a half bushel to three pecks of seeds per acre. When sown with small grain for hay, sow from 15 to 20 pounds of vetch seed and a bushel and a half of oats, or three pecks of wheat, or a half bushel of rye, to the acre. This should be done at the proper time for sowing the oats, wheat or rye.

Vetch hay is easier cured than clover hay. When sown with wheat or oats, cut when the grain of the wheat or oats is in the dough stage. For hay, vetch is preferable to crimson clover as it is not so apt to cause the formation of the so-called "hair balls" in the intestines of horses as does over ripe crimson clover; also, it makes a hay higher in protein contents than clover will.

For inoculation use either soil from a field that has recently grown vetch or use the culture as for other legumes.

FIG. 30.—Field of Iron cowpeas broadcasted thinly.
U. S. Bulletin No. 318.

Cow Peas.

Cow peas are too well known in North Carolina to need any description in this BULLETIN. They are the most widely distributed legume crop that we have. The acreage in cow peas probably equals that of all the other cultivated legumes grown in the State. They are good for man and beast, and also for the land. When properly cured they make a hay almost equal to wheat bran in feeding value. A ton of good cow pea hay contains more than three times the protein that timothy hay has, and about one-third the nitrogen contents of a ton of cottonseed meal. The acreage grown in cow peas has very much increased within the

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past few years. The greatest drawback to growing them is the cow pea wilt, a disease that will live for years in the soil and for which there is yet no known remedy, except a long crop rotation in which cow peas nor beans of any kind should be grown. Even then it might require several years for the disease to die out of the soil.

Wilt is a soil disease and attacks the pea at any time from germination up to its full growth, but usually when they are from four inches to a foot high. The leaves begin to droop, turn yellow and fall off, and the plants die. Where the wilt exists the only way to grow cow peas is to plant wilt-resisting varieties, the best of which are the Iron and Brabham varieties.

Another great drawback is the manner of harvesting them for seed. The usual custom is to hand-pick, which is very slow, but about the surest of any way yet tried. There have been several pea harvesters put on the market, but I do not know that any of them have proven a success under all conditions. Where the peas are of the bunch variety and stand up in good shape, the harvester will gather them all right, but when they sprawl all over the ground I know of nothing but the hand picker that will get them clean. Until some means of gathering them cheaply is brought out we may continue to expect high priced peas.

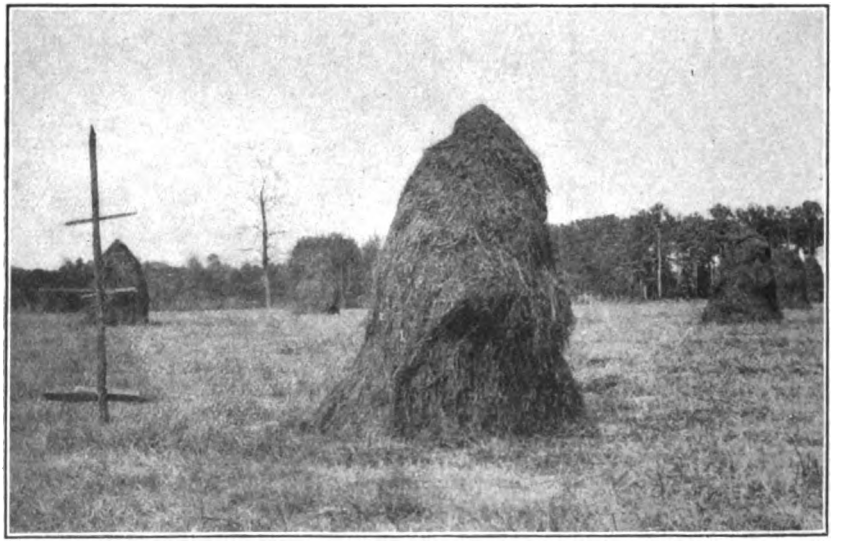

FIG. 31.—Method of curing cowpea hay, near Goldsboro, N. C.
Original. Photo. by J. M. Gray.

Pea Vine Hay.

For hay making the more erect varieties are easiest handled. Cutting the long vined trailing varieties for hay is a job. For that reason I prefer the erect or semi-erect varieties for this purpose.

In making pea vine hay it will be well for farmers who have been making it for some years and who have succeeded with their methods

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to stick to it until they are convinced that a better plan is proposed. Then they can adopt the better plan.

The writer has been curing pea vine hay for twenty-five years and sticks to the plan he has been successful with all these years. His plan is that of using short stack poles about ten feet long. Set them in the ground some eighteen inches deep, or enough so the wind will not blow them over. Nail two cross-pieces about five feet long at right angles to each other, about ten or twelve inches above ground so as to prevent the vines from lying on the ground. The vines are cut after the dew is well dried off and let lie until the following evening, if the weather will permit, then rake into good-size windrows before the vines become damp from dew and let them remain there until the following day, when they are carried to the stack with the hay rake, which is a rapid process. The vines are placed around the stack pole and on the cross-arms, without tramping, until about three feet high. Then nail on one cross-arm and pile on vines until about three feet more are on. Then nail on another cross-arm at right angles to the last one nailed on and continue this until the stack is finished. I like to have the top of the stack pole pointed and a large forkful of vines placed on this and arranged around the stack umbrella-like so as to prevent water from running down the pole. When well cured and it is convenient to do so, we bale the hay and store it in the barn. We use pine poles and by skinning them when first cut and taking them up and stacking away as soon as the hay is taken from them, we find they will last several seasons.

For more detailed information about cow peas, their fertilization, cultivation, varieties, etc., see June, 1910, Bulletin No. 6, issued by the North Carolina Department of Agriculture, Raleigh, N. C.

Soy Beans.

The soy bean, also known as Japan pea and Soja bean, is another of the good things that have come to us from Asia. The writer first grew it in 1872. It was then known as Japan pea. But its real worth and value have not been appreciated by us until within the last few years. The high price of cow peas has given the soy bean an introduction in many counties of the State where it was hitherto unknown. It is an exceedingly valuable acquisition to our hay and forage crops. It also yields large crops of beans in the black soils of the eastern part of the State. I have had farmers tell me they could make as many as 35 to 40 bushels of beans per acre. Of course those are exceptional yields, but it shows the possibilities of the soy bean. It makes hay of the finest and most nutritious quality. In fact it has a higher feeding value than cow pea hay, which is saying a good deal for it. As a forage crop, especially for hogs, it is exceptionally fine. For best results the hogs should be turned on them about the time the bean in the pod has reached its full size, and before it begins to harden, while the leaves are still green. The hogs will first eat the leaves, then the remainder of the plant until there is only the hard stalk left.

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While soy beans are best adapted to the eastern part of the State they also do well in the Piedmont section and in the mountains. In fact they will do better in the mountains than the cow pea will, because it can be planted earlier and will stand frost better than the cow pea. Another advantage the soy bean has over the cow pea in the cow pea wilt section is it is more resistent to wilt than the cow pea. Good

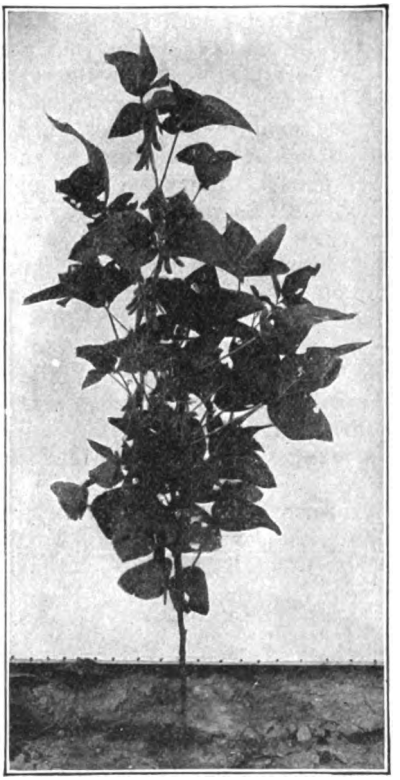

FIG. 32.—A plant of the Mammoth variety of soy bean, showing its characteristic habit of growth. Height, 40 inches.

From Farmers Bulletin, 372.

crops of soy beans can be grown where the cow pea wilt exists, but in doing so you prolong the time of getting rid of the wilt.

Varieties.

There are probably 40 to 50 varieties of soy beans, but we are interested in those now known to be best adapted to the soil and climate of our State, which are Mammoth Yellow and Hollybrook. A brown variety has been introduced into the eastern part of the State within the past two or three years and is giving satisfaction, but I do not know the name of it. The Mammoth is more largely grown in this State than

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all other varieties, but is later in maturing than the Hollybrook, therefore where the seasons are short it would be advisable to plant the Hollybrook. The Hollybrook is also a yellow seeded variety, the seed smaller and the growth not as rank as the Mammonth. Doubtless some of the other promising varieties will soon be tried out at the Test Farms and the results made known to our farmers.

Preparation of the Soil.

Soy beans require good preparation of the soil. Slipshod preparation usually results in either a failure of the crop or a very much diminished yield. They can be either sown broadcast at the rate of a bushel per acre or planted in rows and cultivated. The latter plan gives best results. The rows should be from 2½ to 3 feet apart and the

FIG. 33.—A field of the Mammoth variety of soy bean in North Carolina.
Farmers Bulletin 372, U. S. Dept. of Agriculture.

beans planted in hills of three or four beans every 6 or 8 inches, or distributed along the row at the rate of one bean every 2 or 3 inches. The locality in which they are planted, the soil and drainage, should govern the width of the rows and also the distance the beans are in the row. In the rich black soils of the eastern part of the State the distance should be greater than in the central or western part of the State. They should not be covered over an inch deep. Early planting usually gives better results than late plantings. Care should be exercised in securing seed for planting. It is not safe to plant seed that have been carried over a year. They deteriorate very rapidly. Unless properly cared for when first harvested they will heat and their power of germination will be weakened. In purchasing seed buy only bright plump seed, the viability of which is guaranteed. In the eastern

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and central part of the State they can be planted from April to the middle of July, but the April and May plantings will be more satisfactory.

As soil improvers they do not rank with the cow pea when cut for hay. This is because they can be harvested much cleaner than cow peas and also their root system is not as large as that of the cow pea. But if the crop is to be plowed under it is probable the results will equal those of the cow pea.

Soy Bean Hay.

Soy bean hay when cut at the proper stage of growth and well cured is relished by all kinds of stock. I have never fed hay that was eaten

FIG. 34.—Roots of soy bean showing nodules.
U. S. Bulletin No. 214.

more readily than a good quality of soy bean hay. The beans in the pod should be about half or three-fourths grown when cut for hay. At that time the leaves are still green and will not readily fall off in handling the hay. Cut after the dew is off and let lie until the afternoon. Rake into windrows and remain until the next afternoon. Then put into tall cocks and let them alone until they get quite warm. Then

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spread for a few hours until cool and stack or put into the barn. This plan was given to me by a farmer who lives in the soy bean territory of eastern North Carolina, who said the heating process in the cock had a tendency to soften the stalk and to make the hay of better quality. The plan for curing cow pea hay given in another part of this BULLETIN will also answer for soy beans.

Inoculation.

Soy bean bacteria seems to be more widely distributed than that of any of the legumes, unless it is the cow pea. Soy beans find natural

FIG. 35.—Roots of velvet bean showing nodules.
U. S. Bulletin No. 214.

inoculation in almost any section of the State; therefore it will be unnecessary to inoculate for them unless it is known that the bacteria is not in the soil to be planted. If after growing them one season no nodules appear on the roots, that is evidence that the bacteria are not present in the soil and that inoculation is needed. Soil from a field that has the bacteria or culture for soy beans can be used. Apply as recommended for the clovers, etc.

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The Velvet Bean.

In North Carolina the velvet bean could hardly be considered an economic crop for other purposes than that of soil improvement, and only for that in the cotton growing territory.

This plant has been grown in Florida for a number of years, where it succeeded finely, but with us the seasons are too short for its full maturity. For that reason we will have to look to Florida for our seed. It is a rank growing plant, the vines often growing fifteen or more feet in length under favorable conditions.

The seed can be broadcasted or planted in rows, but best results will be obtained when planted in rows and cultivated. When planted in rows the rows should be 4 or 5 feet apart and the hills from 2 to 3 feet apart in the rows. Plant about 3 beans to the hill. They should be planted about the middle of May.

In the vicinity of Raleigh I have seen a field of velvet beans that was waist high when killed by frost. The crop was used for the purpose of turning under for improving the soil. But with our short seasons it is questionable if velvet beans will prove to be a better soil improver than cow peas or soy beans. They can be tried on a small scale and each person determine for himself which crop is best suited to his soil and conditions. They will doubtless do much better and grow a more satisfactory crop on the lighter soils of the eastern and southern parts of the State than they would on the clay lands or heavier soils of the Piedmont section. If nodules fail to appear on the roots, that is evidence that inoculation is needed.

For more detailed information about the legumes treated in this BULLETIN I refer the reader to the following bulletins issued by the United States Department of Agriculture, Washington, D. C. They are to be had by writing to the Secretary of Agriculture, Washington, D. C.

Farmers Bulletin, No. 214, Beneficial Bacteria for Leguminous Crops.
Farmers Bulletin, No. 455, Red Clover.
Farmers Bulletin, No. 550, Crimson Clover.
Farmers Bulletin, No. 485, Sweet Clover.
Farmers Bulletin, No. 441, Lespedeza or Japan Clover.
Farmers Bulletin, No. 339, Alfalfa.
Farmers Bulletin, No. 515, Vetches.
Farmers Bulletin, No. 529, Vetch Growing in the South Atlantic States.
Farmers Bulletin, No. 372, Soy Beans.
The Culture of the Cow Pea, North Carolina Department of Agriculture, No. 6, June, 1910, Raleigh, N. C.

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THE BULLETIN

OF THE

NORTH CAROLINA

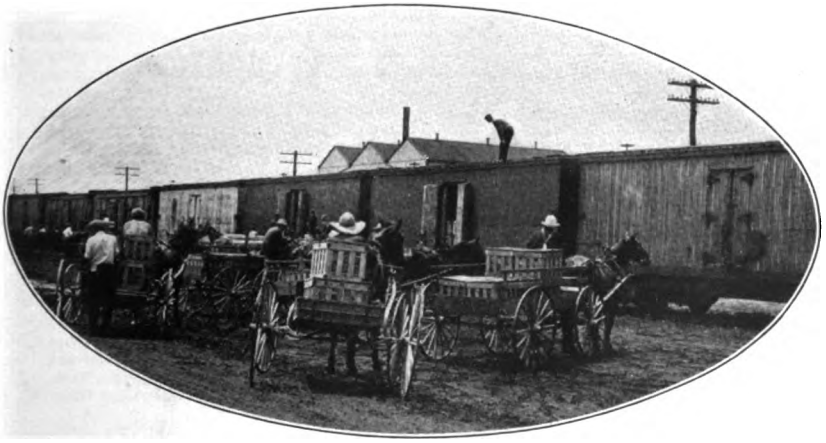
DEPARTMENT OF AGRICULTURE,

RALEIGH.

Vol. 34, No. 8. AUGUST, 1913. Whole No. 187.

COMMERCIAL STRAWBERRY CULTURE

By S. B. SHAW.



LOADING STRAWBERRIES INTO ICED CARS.

PUBLISHED MONTHLY AND SENT FREE TO CITIZENS ON APPLICATION.

Entered at the Post-office at Raleigh, N. C., as second-class matter, February 7, 1901, under Act of June 6, 1900.

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LETTER OF TRANSMITTAL.

RALEIGH, August 1, 1913.

SIR:—I herewith submit for publication a manuscript on the commercial culture of the strawberry, by S. B. Shaw, Assistant Horticulturist. This work was assigned to Mr. Shaw two years ago, and since that time his investigations have been carried on under my direction on the Pender Test Farm and throughout the commercial strawberry sections. While not neglecting the culture of the strawberry for home use and local market, this BULLETIN is designed especially to encourage the commercial production of this fruit for shipping to northern markets.

I wish to acknowledge the kindness of Professor Sherman, State Entomologist, in preparing the valuable section on strawberry insects.

Respectfully,

W. N. HUTT,
State Horticulturist.

Approved for publication:

W. A. GRAHAM,
Commissioner of Agriculture.

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COMMERCIAL STRAWBERRY CULTURE.

By S. B. SHAW, Assistant Horticulturist.

There is probably no branch of horticulture that has developed in the past twenty years more strikingly than has the commercial culture of the strawberry. It has grown in a quarter of a century from a more or less general and relatively unimportant business, to a highly specialized one of great importance. While strawberries have been grown for centuries, it has been only within the past decade or so that their commercial culture has attained the prominence it now holds in the fruit-growing industry. Ripening as they do early in the season, strawberries come on the market at a time when every one has a craving for fresh fruit that is not satisfied with the citrus, subtropical, and other fruits that have been on the markets during the winter months.

So far as the growth and perfection of the fruit is concerned, there is no section of the State where the finest strawberries cannot be grown. The main point to be considered in the cultivation of this fruit for market is the fact that the strawberry is grown commercially in all parts of the country, and that each section from Florida to Maine has its own season. Hence, to make strawberries profitable for shipment to the north, they must be grown where the climatic conditions warrant an early ripening of the fruit, so that it can be placed on the market before localities further north come in with their berries. For this reason the culture of the strawberry as a commercial crop has been confined to the lands of the coastal plain, where soil and climatic conditions combine to make this business profitable.

While the coastal section will always be the region for profitable strawberry growing for northern markets, yet the increasing number and size of the towns and cities in the State will create home markets for a great deal of fruit of all kinds. This will naturally result in the development of the strawberry industry in other localities, for the supply of local demands. Home markets are apt to be overlooked and poorly supplied. The demand for berries of high quality is always good and is ever increasing with the annual increase in population. Even with an excess of fruit, there would be room for the development of canning industries to compete with similar establishments in other States.

SOILS AND THEIR PREPARATION.

Strawberries can be grown on almost any type of soil, if the land is well prepared and supplied with a sufficient amount of available plant food. The ideal berry soil is a mellow, well-drained loam. Land that has a natural tendency to bake should be avoided, as it is difficult to keep down weeds on this type of soil, and it is also hard to conserve

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soil moisture in a dry time. As a rule, sandy loams will produce early fruit, but the stiffer clay loams usually produce larger yields. There is much advantage in having the land level, or nearly so, as cultivation is more easily carried on and there is less loss of fertility through leaching and surface washing during heavy rains. However, if the level location is situated lower than the surrounding land, it is not advisable to use it, because of the liability to damage from frosts resulting from the settling of cold air from the higher elevations.

There is a difference of opinion as to whether newly cleared land or soil that has had previous cultivation is most desirable for planting to strawberries. Newly cleared land is easier to cultivate on account of there being fewer weeds to contend with. Some growers are of the opinion that this kind of soil will produce better fruit and larger yields than land that has had previous cultiivtion. In either case, whether the land be new or old, an ample supply of moisture and a liberal amount of readily available plant food must be present in order to promote the growth necessary to make the growing of strawberries profitable. Deep plowing, the presence of plenty of humus, either in the form of stable manure, some soiling crop, or what may occur naturally, and thorough tillage, will improve the physical condition and increase the amount of fertility of almost all soils. This is particularly true of clay and sandy land. Black, peaty bottom-land usually contains plenty of vegetable matter. In addition to deep plowing and careful tillage, soils of this character can best be improved by drainage and the application of lime. As a rule, the more care and attention given the preparation of land the more readily can cultivation be carried on and the more profitable will be the yields.

FERTILIZERS.

One of the most important points to be considered in the growing of strawberries is that of fertilization. Very often growers fail to grasp the significance of this operation in the production of their crops. Where strawberries are grown for home and near-by markets the chief consideration is yield, size, and flavor of the berries. If the fruit is to be sent to more distant markets, texture should be most carefully considered in addition to the other qualities, for berries that are not firm will not stand long transportation. As a rule, an abundance of nitrogen will produce heavy yields and large berries, but sufficient phosphoric acid and potash, in available forms, are needed to develop the flavor, color, and firmness of the fruit. Growers who contemplate sending their berries any distance, even though they be under refrigeration, may well consider the amount of phosphoric acid and potash they are supplying to their plants, for no matter how large and beautiful the fruit may be, unless it is of firm and solid texture, it will not carry successfully.

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Well-rotted stable manure is perhaps the best general fertilizer that can be used under average conditions in the growing of strawberries. When applied to the preceding crop there is less danger of injury from the "white grub." While it is doubtless true that stable manure can hardly be equaled, few growers are so situated as to be able to obtain all they need. As a result, artificial fertilizers, or commercial fertilizers as they are commonly called, have been introduced, and in many instances their use has proved even more advantageous than stable manure. These fertilizers are of different materials which contain some form of ammonia, potash, or phosphoric acid, derived either from organic or inorganic sources. Complete fertilizers contain all three of these principal plant-food ingredients. When fertilizing material of this kind is depended upon exclusively, the use of some soiling crop or other source of vegetable matter becomes of the utmost importance in order to supply the soil with a sufficient amount of humus. The use of these fertilizers alone, without the addition of sufficient vegetable matter, will soon leave the land in an impoverished, unproductive condition. As each particular crop requires a certain amount of the necessary elements of plant food, and as soils vary considerably in their content of these elements in an available form, growers can best learn from personal experience the fertilizing material most suitable for their particular land.

The kind and amount of fertilizer used by different growers varies with the location and the natural conditions under which the plant food is to be applied. As a rule, the lighter sandy soils of the coastal plain need more potash and less phosphoric acid than do the heavier clay lands. The most universally used fertilizer in the coastal section, and the one that seems to have produced the most profitable results, is one that contains 8 per cent available phosphoric acid, 3 per cent nitrogen, and 10 per cent actual potash. This is applied at the rate of from 1,200 to 2,000 pounds per acre, in two applications. One application is made about July or August and the other in December or January. Some growers prefer to mix their own fertilizers, believing that in this way they can obtain more satisfactory results at less cost. Fish scrap, tankage, or dried blood are most commonly used as a basis for the nitrogen; acid phosphate, bone phosphate, and muriate of potash as their source of phosphoric acid and potash. Cotton-seed meal is also used in combination with these materials. On some of the heavier loam soils containing more clay, certain growers have found it profitable to apply about 500 pounds of raw bone or dissolved bone per acre two or three weeks before setting the plants. The same application is repeated in the fall at the last cultivation, and continued in the same way the following season. In addition to this, a top dressing of about 500 pounds per acre of a fertilizer having 6 per cent available phosphoric acid, 3 per cent nitrogen, and 6 per cent actual potash is applied in the spring.

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Where strawberries are grown for home use and for the local market in the piedmont and mountain sections, stable manure forms a good basis for an excellent fertilizer. This may be supplemented by the use of a fertilizer having a little less potash than that used in the coastal sections. Here, too, the grower can be the best judge as to what will give the most profitable returns, since local conditions and environment influence the growing of all crops in all localities.

VARIETIES.

The selection of suitable varieties is one of the most important things to be considered in the commercial planting of strawberries. In no other class of fruits are there so many varieties to choose from. Some varieties seem to be well adapted to certain conditions, such as a sandy soil and a warm climate, while others do better in a heavy clay soil and a cool climate. No one can tell just which variety will do well in a given section until tests have been made with several varieties. It is well for a grower to make such tests on his own place rather than to take the word of another grower who has tried the recommended variety, but probably under different soil and climatic conditions that would have a big influence on the production.

It is well in selecting varieties to know whether the plants have perfect or imperfect flowers. The perfect flowers have stamens and pistils and are capable of pollinating themselves. Those known as imperfect flowers have pistils only, and are not capable of bearing fruit unless pollinated from some perfect flowered variety.

In selecting a variety having imperfect flowers, care should be taken in planting to have every third or fourth row of a variety with perfect flowers to insure ample pollination. Where strawberries are grown on a large scale for distant shipment, it is generally advisable to select only varieties having perfect flowers. In large commercial plantings, growers are compelled to depend upon all sorts of hired help for harvesting their crops. Where mixed varieties are planted, under conditions of this kind, it is almost impossible to have the pickers keep the varieties separate, and as a result two and sometimes more varieties are put in the same basket. One of these varieties may be more tender than the other, and as a result the contents of the entire package usually presents a very mussy and unattractive appearance when it reaches market. There are, however, instances when it might be advisable to plant two or more varieties together in the same field, notwithstanding the difficulty which may arise in harvesting the crop. In localities where the strawberry weevil has become a serious pest, the planting of varieties having imperfect flowers will in part lessen the damage done by this troublesome insect. As the larva of the weevil eats pollen, its feeding area is very much restricted when only every third or fourth row in the field is planted with perfect flowering varieties.

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Of the several varieties of strawberries grown on a commercial scale in the eastern part of the State during the past few years, the Lady Thompson and Klondyke have been the most popular. Most growers in this section seem to consider the Thompson the heaviest yielder, but it does not seem to stand shipping so well as the Klondyke. There is not so very much difference in the average yield of these two varieties, and as a result the Klondyke, because of its good shipping qualities and deep red color, is considered the most profitable variety by the majority of the growers. A newer variety that has gained much prominence in the Norfolk section, because of its superior shipping quality and productiveness, is the Missionary. This variety is being planted by a number of growers who are expecting to find in it a berry of even more desirable qualities than either the Thompson or the Klondyke.

Where growers do not plant on a large scale for shipment to northern markets, there are other varieties of excellent quality that can be profitably grown. The Excelsior and Haviland are two excellent varieties for planting for local or near-by markets. On account of their rather soft texture, they are not well suited for shipping long distances. Both berries are of high quality, the Excelsior being very early and the Haviland a mid-season fruit. There is usually a good demand on the home market for a succession of strawberries from the earliest to the latest varieties. Very often a profitable business can be developed from a succession of this kind when the grower keeps in mind the demands of the home trade.

PLANTING.

Strawberry plants may be set successfully either in Spring or Fall. If good plants are obtainable, early Spring is the most desirable time to plant. At this season the soil is in good condition, cool and moist. When properly cared for and well cultivated, plants carefully set at this time will make rapid growth and will produce a full crop of fruit the following season. However, plants can be set with equal success in the Fall, and where the weather is seasonable, this time is much preferred by many growers.

To properly set plants, shorten the roots in to 4 or 5 inches and cut off about half the leaf growth. With a trowel, spade, or dibble make a hole in the ground sufficiently large to permit the roots being spread out in the shape of a fan. Press the soil firmly about the plant, covering all the roots and the lower part of the crown. The top of the crown should be a little above the level of the ground. This allows the growing plant to develop without hindrance. Should the plants be set too deep the crowns may rot; if too shallow, or if the soil is not pressed firmly about them, the roots may dry out.

When plants are secured from a distance they should be ordered so as to arrive at a time when the planting can be done immediately, provided, of course, that weather conditions are favorable. If the planting must of necessity be delayed, open the package as soon as it arrives and

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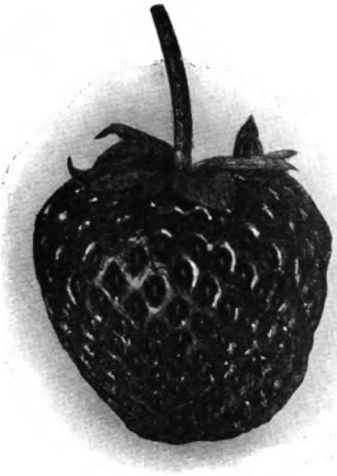
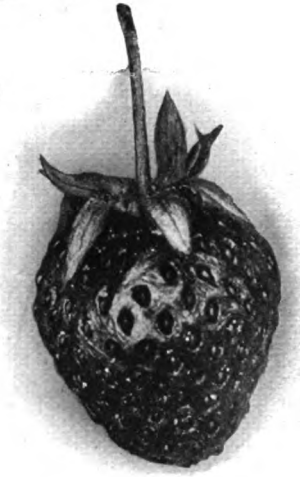
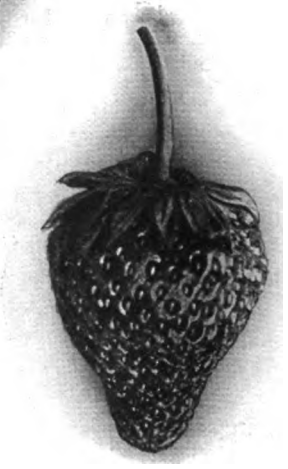


I. Klondyke.



II. Lady Thompson.



III. Missionary.

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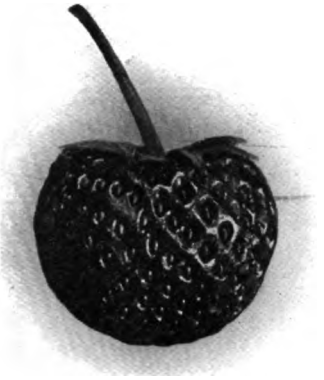
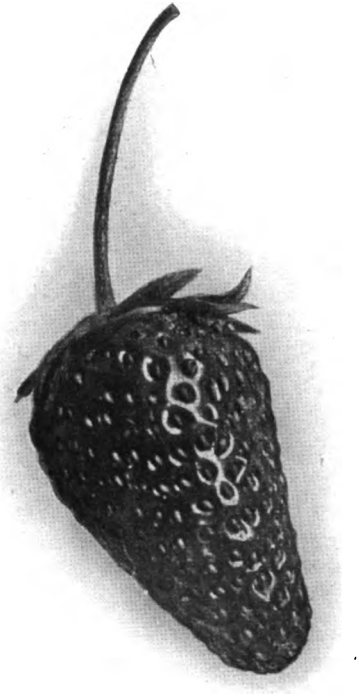


IV. Excelsior.



V. Haviland.

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heel the plants in, in some place where the soil is well drained. Place the plants close together in the trench and cover the roots the same as in planting in the field, but use the same care in not covering the crown of the plant. After bedding plants in this way pack the earth firmly around the roots so that they will not dry out before they are set in the field. If loosely heeled in, plants are apt to die.

CULTIVATION.

The common method of cultivating strawberries in the eastern part of the State, that is, in the coastal section, is to confine the plants to the hill system. Most growers claim that larger yields of better fruit can be produced in this way. The cost of cultivation, however, is increased to a certain extent by this system. All runners must be removed from the main plant, and as this work can best be done by hand, it adds to the cost of production. When weather conditions are favorable throughout the growing season the hill system proves very satisfactory. Sometimes when the season is exceedingly wet these plants make an excess of growth which is not desirable. The semimatted row, or modified hill system of growing strawberries as followed by other growers is not so apt to make an excess of plant growth. The expense of cultivation under this system is also lessened, and those who advocate this method of growing berries claim that it is equally as profitable as the hill system. The hill system of cultivation is shown in Fig. 1. Matted rows are shown as a comparison in Fig. 2.

The fundamental principles of cultivation are applicable to the successful growing of strawberries, whether they be planted in hills or in matted rows. Plants grow, develop, and mature their fruit in proportion to the amount of available plant food at their disposal. The greater part of this plant food is in the soil, occurring naturally, or supplied by artificial means. It cannot, however, be made use of by the plants until rendered available. This condition is brought about by the combined action of several agencies, most important of which are temperature, air, and moisture. Tillage promotes the work of these agencies, and, as a result, influences the growth of the plants, thereby affecting the development and quality of the fruit. Poorly fed, badly neglected plants cannot produce marketable fruit.

After the crop of strawberries has been harvested, deep cultivation can be given the plants. This should continue until about the last of August or first of September, when the plants will begin to send out a number of fresh surface feeding roots. From this time on cultivate shallow and only enough to keep down the weeds. If these new roots are materially disturbed, it will have a similar effect on the plants to root pruning, and as a result next season's crop is likely to be later.

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FIG. 1. The hill system of cultivation.

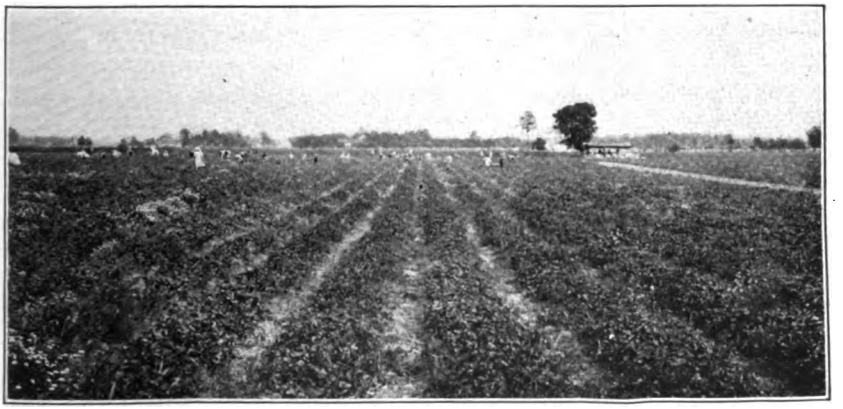

FIG. 2. The matted-row system of cultivation.

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MULCHING.

The mulching of strawberries, in the South, is considered by some to be an unnecessary and expensive operation. By others it is looked upon as a necessary part of the work in the production of a profitable crop. There is no doubt that there are several good reasons why mulching can be practiced to good advantage. The primary object in applying a mulch to strawberries is to protect the plants from winter or spring injury. Besides affording protection to the plants, mulching aids in the conservation of moisture in the soil by hindering evaporation, retains the surface soil in a loose, friable condition, and in some instances adds plant food to the land. This is particularly true where stable manure has been applied as a mulch. Mulching also aids in cultivation by checking the growth of weeds. In some sections hay or straw are used for mulching, in other places dead weeds, vines, or leaves are used. In the eastern part of the State pine straw affords excellent material for this purpose. See Fig. 3. When the mulching material is left between the rows and around the plants, after having been raked off of the plants in the spring, it keeps the fruit away from the ground and prevents it from becoming sanded during heavy rains that may come while the berries are ripening. Of the several advantages derived from mulching, this last named is a very important one. No one cares for "gritty" berries, and when fruit of this kind is offered for sale, be it at home or on the distant markets, it is disposed of at a discount that often proves to be a loss to the producer. There is never a demand for gritty fruit at any price.

PICKING.

Frequently too little attention is paid to the picking of the strawberry crop. Often the financial success of the grower depends upon this one operation. The state of maturity at which strawberries can best be picked depends upon the market for which they are intended. Berries for the home or near-by market can be gathered in a much riper condition than fruit intended for shipping long distances. For distant markets, strawberries must be gathered as soon as fully grown and the color well developed. It would be impossible to give exact rules for determining the best time to harvest any variety. This can best be learned by personal experience, guided by the ripening habit of the varieties grown. Some varieties begin to soften before they have taken on much color, while other varieties remain quite firm after having become fully colored.

Strawberries should always be picked with stems on. Fruit that is "snapped" from the plants will not stand long transportation. As berries are gathered they are placed in quart baskets or boxes and carried to the packing shed on trays holding usually from 10 to 12 quarts. Some growers provide special help for carrying the fruit from the field to the packing shed as soon as it is gathered, as illustrated in Fig. 4. This

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FIG. 3. Showing pine straw used as a mulch.

FIG. 4. Carrying berries from field to packing shed, as they are picked.

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method keeps the berries in much better condition than where they are allowed to remain in the field until brought in by the pickers.

GRADING.

Carefully trained pickers can do all the grading and sorting necessary, as they gather the strawberries. They should be instructed to place all small, inferior, and over-ripe berries into separate baskets, and under no circumstances to put specimens of this kind into baskets with good fruit intended for market. Specially constructed carrying trays can be provided each picker, as illustrated in Fig. 5, on which four baskets can be placed for holding the two grades that are gathered at the same time. Growers who adopt this method of picking and grading pay their pickers full price for gathering the inferior fruit. The establishment of this system among pickers necessitates careful watching on the part of the grower, but those who have tried it have found that it has proved decidedly profitable. This method of grading eliminates the necessity of rehandling the fruit after it has been brought to the packing shed. Trained pickers can also face each basket, thereby increasing the attractiveness of the package. This is easily done while picking by placing the last layer of berries stem end down. Facing is an honest and perfectly legitimate practice, provided the entire contents of the basket are fruits of the same grade as those placed on top. Small and inferior berries scattered throughout the baskets in a crate, be it ever so nicely faced, will give the buyer an opportunity to discriminate against that grower's pack the entire season, and, as a rule, buyers remember instances of this kind from one season to another.

PACKING.

Packing is an important operation in the preparation of strawberries for market. Berries should be cool and dry before being placed in the crate. Heat and moisture promote decay. Conditions of this kind should be guarded against, for decay means loss. Fruit that has become cool and dry before being packed will keep longer and appear to best advantage at the time of sale. No strawberry grower's equipment is complete without a conveniently located packing shed properly arranged for the cooling and drying of the fruit. A building of this kind need not be made of expensive material, but the construction should be such as to allow a free circulation of air and at the same time shade the berries. A well arranged house of this kind is shown in Fig. 6. A shed having ample circulation of air, but not affording much shade for the fruit, is shown in Fig. 7.

Before packing in the crate, see that each basket is well filled, with the berries placed firmly and snugly. Every day, consignments are placed on the market showing evidences of careless packing. Consider for a moment the average route traveled by a crate of berries. The

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FIG. 5. Pickers using specially constructed carrying trays.

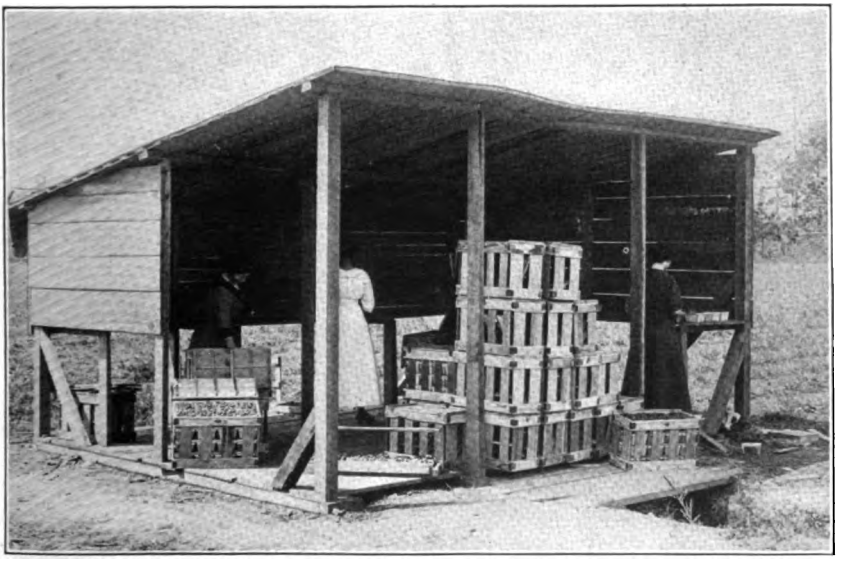

FIG. 6. A well-arranged packing shed, affording ample protection for the fruit.

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FIG. 7. A shed affording ample circulation of air, but little protection for the fruit.

package is taken from the packing shed and loaded into a wagon. It is then hauled, say, from 1 to 6 miles over the average country road to the railroad station, where it is again transferred to a car. After traveling from 20 to 200 miles, and possibly more, it is again unloaded and placed in a wagon and this time hauled for several squares over the city streets, until it finally reaches its destination and is ready to be opened for the inspection of the general public and the criticism of the possible buyer. Unless this crate has been well filled and packed before starting, as illustrated in Fig. 8, it will reach the market in what is commonly called a "slack" condition. The numerous handlings and jarrings received en route will have caused the contents to settle and shrink, and as a result the package will be only partially full. Buyers cannot be expected to pay the price of full packages for those only filled in part.

THE EXPERIENCE OF A PRACTICAL GROWER.[1]

"I have thoroughly tried many varieties of berries, and have come to the conclusion that the Klondyke has proved to be the most profitable, although I am inclined to believe that the Missionary may yet be better at my distance (3⅓ days) from the markets, as it is a firmer berry than either the Lady Thompson or the Klondyke. I am also inclined to think that the Missionary will prove to be more prolific.

[1]The experience here given is that of one of the most successful growers in the State. This man has made a reputation for producing first-class fruit that brings a profitable price on the market. During the past two years (1912-1913) the average net return per acre for his strawberries was a fraction over $211.86.

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FIG. 8. Showing a well filled and packed crate as it appeared on the market.

"So far as production is concerned, I have produced more crates to the acre of Lady Thompson than of Klondyke, but have received more money per acre for my Klondyke than I have for my Lady Thompson, or could ever hope to.

"When berries are to be shipped to places three or four days journey away, it is a mistake to apply too much plant food, particularly nitrogen, in the attempt to produce large berries, as this has a tendency to weaken the texture and carrying quality of the fruit. However, if the

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berries are to be sent to markets nearer home, there is not so much danger of overfeeding the plants.

"I have found that newly cleared land that has been thoroughly worked some three or four weeks before setting the plants is ideal, but it is not at all essential to profitable berry growing. Old land, preferably a gray, mellow, moisture-retaining soil, underlaid with red or yellow waxy clay 8 to 10 inches below the surface, will hardly fail to produce a good crop under average normal conditions. I find that where the subsoil is only 6 inches from the surface, subsoiling more than pays for the labor expended. It is true that there are other lands that will produce highly profitable crops of berries. Land, not subject to overflow, on which corn grows well without showing a tendency to 'fire up,' can be depended on to make berries. I have found that land with a whitish clay is not so good, but if the water level is not more than 2½ to 3 feet below the surface it will produce fair yields. Crawfish land, in my experience, will show up well the first year, but the second year the plants will amount to but little.

"After my crop of berries is off, I always cultivate deeply, and find that by so doing my plants are greatly benefited. I continue to cultivate deeply and often until about the 15th of September. At about that time the nights begin to get cool, and the plants, if properly cultivated, begin to send out hungry surface roots. I let these roots remain, and never plow them off, because I find that if this is done the crop is made to come late. To avoid working off these roots, I begin in time and put in my fertilizer, 6 bags of 8-4-10 to the acre, and thoroughly work it into the soil from 3 to 6 inches from the plants, being careful to work the soil up close to the plants, but without smothering them. From then on I cultivate only to keep down the weeds, and never deep, especially near the plants. I never grow runners unless I specially need the plants for setting.

"I find that my best results are obtained from plants set the latter part of August. Spring is a good time to set the plants out, but they do not make such large berries, and require more cultivation on account of the weeds. The August-set plants, besides producing a crop in the Spring, require only two or three months cultivation.

"I use 400 pounds of raw bone meal worked into the bed two or three weeks before setting the plants, and get excellent results. There are other fertilizers probably just as good, but I find that this gives the best results for me. Of course, the amounts of fertilizer used throughout the season have to be varied according to the nature of the soil. Usually from 1,000 to 1,400 pounds per acre for the entire season is ample.

"I always use the hill system of planting and put my plants about 14 to 16 inches apart. In this way I get better, cleaner, and larger berries than I would in the matted rows.

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"There is much room for the development of the strawberry industry. Our berries are often sent to market in bad order, soft, moldy, or 'leaky.' This could be avoided if we growers would refrain from using too much ammoniated fertilizers. For instance, we should never use nitrate of soda later than the middle of September. This gives the plants time to take it up before the cold weather sets in, otherwise the plants do not get the benefit of it until the following spring, and the consequence is that we have a soft berry and a poor shipper."

STRAWBERRY INSECTS.[1]

By FRANKLIN SHERMAN, JR., Entomologist, State Department of Agriculture, Raleigh, N. C.

The strawberry crop has very few serious insect enemies in North Carolina, but we here mention those that have been complained of. The only one of which we have ever had much complaint is the Strawberry Weevil.

Strawberry Root-Louse.—This is a small dark plant-louse which infests the roots, sucking the sap from them, sometimes killing the plants in spots in the field. The remedy is (1) to avoid planting in ground known to be already infested until it has been in some other crop for a year or two; (2) secure plants which are free from them, grown in fields not infested; (3) if the plants are suspected, dip them for a few minutes in strong decoction made by boiling tobacco stems or leaves in water.

Strawberry Root-worms.—These are the larvæ (worm stage) of small dark-colored beetles. The beetles feed on leaves of strawberry and other plants; the larvæ feed on the roots or may bore through the crown. Remedy is to spray with arsenate of lead, 3 or 4 pounds to barrel of water, or Bordeaux mixture, applying well before the berries begin to color or after picking is over. So far as known, these are not usually a serious pest with us.

Saw-flies, Leaf-rollers, Caterpillars.—These may one and all feed to more or less extent on the foliage, but injuries by them have never been reported as serious in this State. Remedy would be to spray as already recommended for the Root-worms.

Strawberry Weevil.—This is by all odds the most important insect enemy of the strawberry in North Carolina, and therefore will be discussed in more detail. It has been the subject of some careful studies by us.

[1]This article was prepared by Mr. Sherman at the request of the author of this BULLETIN, because many growers will desire to have some knowledge of the insect enemies of this crop. Inquiries or complaints about insects attacking strawberries in this State should be addressed to DIVISION OF ENTOMOLOGY, STATE DEPARTMENT OF AGRICULTURE, RALEIGH, N. C.

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The adult parent weevil is less than 1/8 inch long, chestnut-brown in color, and has on each side of the body a black spot which is surrounded by a gray border. From the head there projects a snout a little more than half as long as the body.

Weevils begin to appear in the fields about the last of March or first of April, showing up first along edges of woods, next to ditch banks, fence rows, briar patches, etc. There is no evidence that they are brought in with the pine straw. Within a week they become abundant, and may be found mating. The injury consists in cutting off the stem of the buds after laying the eggs in the bud itself. The larvæ (grub) which hatches from the egg feeds *on the pollen* in the cut and wilted bud. It reaches full growth in the same individual bud in which it is hatched, changes to a pupa, and emerges from the bud as a mature weevil about June 1st to 10th. Meanwhile the bud may still be attached to the plant, but is more likely to have fallen to the ground. After emerging as adults (June 1st to 10th) the adult weevils do not seem to mate, but begin to migrate to woods, hedges, ditch banks, etc., where they may be found on many kinds of flowers, including swamp magnolia, gallberry, blackberry, rose, etc. When laying eggs (April 5th to May 5th) they may be found feeding upon and even cutting the buds of rose, apple, blackberry, etc. There is evidence of only one generation each year, for the weevils emerging early in June were not found mating, but were evidently migrating from the strawberries to the woods, waste places, etc. Hence we believe that the same individual weevils which emerge in June are the ones which invade the fields the following spring and cut the berry buds.

The remedies to be applied are based on the points already brought out in the foregoing discussion, and the severity of damage must determine whether it is worth while to apply them.

As the larvæ (grub) in the bud *feeds on pollen,* the weevil is largely dependent on *pollen-bearing varieties,* and *varieties which bear no (or little) pollen are not so much hurt by weevil.* They will cut the buds of these to some extent, but not nearly so much as the pollen-bearing ones. We are aware that the favorite varieties among our commercial growers at the present are ones which bear pollen, and we are also aware that the pollen bearers are apt to be earlier and to fruit more profusely; but these facts must not blind the growers to the further important fact, that they are most subject to weevil. Hence the grower always has the final chance to escape much weevil injury by using imperfect-blooming varieties, and this is a sort of natural exemption which he can obtain in no other way. Whether the benefit will be great enough to amend for the lighter bearing is always a point on which some chance must be taken, and must be decided by the grower in the light of his experience with the weevil, and with the imperfect-blooming berries.

The second great point in control is this: Our observations showed that the cut and fallen buds gave forth weevils from about June 1st to

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10th, but picking in the same fields (the variety was Thompson) was finished by May 20th to 25th. Here, then, was a space of two weeks when the weevils were developing in the fields, but when the plants themselves had finished their usefulness for the year. A burning over of the fields immediately after the last picking would certainly have destroyed many of the weevils, and if not too severe, would not hurt the plants. Growers who have done this have testified to the benefits. As a matter both of precaution and economy, part of the pine straw may be raked up and saved, the rest distributed evenly and burned. Mowing the tops before burning would make it easier, and if anything less dangerous to the plants.

Ditch banks and borders of berry fields which are overgrown with blackberries, dewberries, etc., should be kept burned off. The two most appropriate times for this would be about April 1st and June 10th, *i. e.*, just when the weevils begin to enter and as the next brood are leaving.

The cleaner the methods of cultivation the better.

An old field, picked for its last time, if it has been heavily infested with weevil, should be burned over, the more severely the better, and then plowed deeply, thus preventing the maturing of the weevils from the fallen buds. Coöperative effort among the growers of a community, all following the same remedial measures, will naturally be expected to give better results than when one acts alone. Yet here, as in most other problems, self-help is the first and most important requirement.

No method of spraying has yet been devised which will control the weevil satisfactorily, but spraying with arsenate of lead in Bordeaux mixture would certainly help against slight injury by Root-worms, Saw-flies, Leaf-rollers, and Caterpillars, and might lessen Weevil injury to some extent; also it will afford much protection against fungous diseases. Four pounds of arsenate of lead to a barrel of Bordeaux mixture is the strength we would recommend, making two applications: first, when leaves are out in spring, but before blooming; second, just after last picking. This last would not be needed if the fields are to be burned over.

FORMULA AND DIRECTIONS FOR POISONED BORDEAUX MIXTURE.

Stone lime (unslaked)	4 pounds
Bluestone	3 pounds
Arsenate of lead	4 pounds
Water	50 gallons

Put the bluestone in a cloth and hang it in a tub or keg of water so that it is just below the surface. In this way it will dissolve much more rapidly than if thrown in so that it sinks to the bottom. Warm or hot water will dissolve it much more rapidly than cold. Put this to dissolve the evening before it is intended to spray and it will be dis-

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*Assigned by the Bureau of Soils, United States Department of Agriculture.
†Assigned by the Bureau of Animal Industry, United States Department of Agriculture.
‡Assigned by the Bureau of Plant Industry, United States Department of Agriculture.

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LETTER OF TRANSMITTAL

RALEIGH, N. C., December 13, 1913.

HON. W. A. GRAHAM,
Commissioner of Agriculture,
Raleigh, N. C.

SIR:—Herewith find my annual report of Farmers' and Women's Institutes for the current year, which I recommend for the January, 1914, BULLETIN.

Respectfully,
T. B. PARKER,
Director of Farmers' Institutes.

Approved for printing:
W. A. GRAHAM,
Commissioner.

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REPORT OF FARMERS' INSTITUTES, 1913

By T. B. Parker, Director of Farmers' Institutes.

During the year, December 1, 1912, to December 1, 1913, we held 260 institutes, each for men and women, with total attendance as follows:

At Regular Farmers' Institutes	34,978
At Regular Women's Institutes	23,007

In addition to the above we held a two-days Normal Institute for institute lectures, a three-day round-up institute and four institutes for negroes.

In many sections we had the hearty coöperation of ministers, school teachers, physicians, and business men, as well as the farmers. We are especially indebted to the newspapers for the many notices they have given of the institutes, and in some instances they have printed the programs in full. We very much appreciate their kindness in this respect.

No premiums were offered at the institutes for men, but premiums of a year's subscription to a woman's magazine were offered to the woman living on the farm, who made and exhibited the highest scoring loaf of bread, and to the woman living on the farm who prepared and exhibited the best school lunch under the conditions set forth in the following circular sent to applicants for information in regard to the exhibits:

Explanations of Premiums Offered at Women's Institutes.

The following explanations in regard to the premiums that we are offering to the girls and women living on the farm for the best exhibits of bread and school lunches at our women's institutes may be of value to would-be exhibitors.

The school lunch exhibit is open to women over 18 years of age only; and the bread exhibit to girls and women. This ruling will be strictly adhered to. In either exhibit the exhibitor must sign a written statement, giving name, post-office address and age, that is, whether she is over or under 18, stating that she made the bread or prepared the lunch, place this information in an envelope, seal it and place with the exhibti. By this means the judge can be sure of getting the name and the address of the exhibitor.

The school lunch is deserving of more consideration than many parents give it. Childhood is an impressionable age and great care should be exercised as to influences that are brought to bear on the child during this critical period in its life. Influences that to us grown people seem small may leave an impression with children throughout their lives. For this reason we should be exceedingly careful as to the kind of influences that surround our children. Cleanliness, and neatness should be among the early impressions made upon the mind of the child. The school lunch is a good means of impressing the child with these habits, or perhaps I might say virtues, for they are virtues.

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The school lunch should have three characteristics, appetizing, nourishing, and easily digested. A normal child of school age requires considerable food to meet the demands of up-keep and growth, so a school lunch should be sufficiently appetizing to induce him to eat freely. It should be composed of the things that will satisfy the hunger of a robust child, and at the same time be so easily digested as to permit the child to study in the afternoon rather than to be put to sleep from the effects of the lunch.

In preparing the school lunch, avoid all soggy foods, all fried meats, unless a small quantity of well fried breakfast bacon may be permissible. Good bread and biscuits, boiled eggs, chicken and fresh meats, butter, sandwiches, ripe fruit, salted peanuts or other nuts, plain cakes and a bottle of fresh milk are sufficient to draw from and will supply the requirements of almost any school child. Sandwiches may be made from home grown vegetables with or without mayonnaise dressing as the child may prefer. The lunch should be put up in a neat basket or bucket and never in a pasteboard box. The latter is not as sanitary as the basket or bucket.

The basis of award will be as follows:

Neatness in packing.....30%
Suitability of food to purpose.....40%
Suitability of food to season.....30%

In judging bread the following score card will be used: Flavor, 35 points; crust—color, depth, texture, 20 points; lightness, 15 points; grain and texture, 10 points; crumb—color and moisture, 10 points; shape and size, 10 points. Size recommended, 7½x3½x2¾ inches.

No award will be given for bread scoring less than 75 points, nor for school lunches scoring less than 70 points.

FARMERS' INSTITUTES, 1913.

County	Date	Place	Lecturers
Alamance	July 24	Oakdale	Burgess, Eaton, Shaw.
	Aug. 21	Elon College	Parker, Cunningham, Shaw.
	Aug. 22	Maywood Academy	Parker, Cunningham, Shaw.
	Aug. 23	Friendship	Parker, Cunningham, Shaw.
	Aug. 25	Hawfields	Shaw, Cunningham.
Alexander	Aug. 23	Taylorsville	Hendricks, Gray, D. T., Nelson.
Alleghany	Sept. 25	Sparta	Gray, J. M., Shaw, Rives.
	Sept. 26	Glade Valley	Gray, J. M., Shaw, Parker, Rives.
Anson	July 24	Wadesboro	Sherman, Gray, D. T., McLean.
	July 25	Peachland	Sherman, Gray, D. T., McLean.
Ashe	Sept. 22	Jefferson	Gray, J. M., Shaw, Rives.
	Sept. 23	Grassy Creek	Gray, J. M., Shaw, Rives.
	Sept. 24	Scottville	Gray, J. M., Shaw, Rives.
Avery			
Beaufort	Dec. 10	Pantego	Parker, Sherman, Browne.
	Feb. 11	Bath	Garren, Hutt, Hill.
	Feb. 12	Aurora	Garren, Hutt, Hill.
	Feb. 13	Washington	Garren, Hill.
Bertie	Jan. 27	Aulander	Parker, Latham.
	Jan. 28	Mars Hill	Parker, Latham.
	Jan. 29	Windsor	Parker, Latham.
Bladen	Jan. 27	Dublin	Shaw.
	Feb. 3	Council	Shaw, Scott.
	Feb. 4	Abbottsburg	Shaw, Scott, McLean.
Brunswick	Jan. 28	Ash	Shaw.
	Jan. 29	Cool Run S. H.	Shaw.
	Jan. 30	Supply	Shaw.
	Jan. 31	Bolivia	Shaw.
	Feb. 1	Winnabow	Shaw.

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FARMERS' INSTITUTES, 1913.

County	Date	Place	Lecturers
Buncombe	Aug. 12	Democrat	Hendricks, Robinson, Holmes.
	Aug. 13	Swannanoa	Parker, Gray, D. T., Meacham.
Burke	Aug. 6	Hildebrand	Sherman, Browne, French.
	Aug. 16	Hickory Grove	Hendricks, Robinson.
Cabarrus	July 30	Harrisburg	Garren, Eaton, Green.
	July 31	Mt. Pleasant	Garren, Eaton, Green.
	Aug. 1	Concord	Garren, Eaton, Green.
Caldwell	Sept. 16	Granite Falls	Shaw, Gray, Rives.
	Sept. 17	Oak Hill	Shaw, Gray, Rives.
	Sept. 18	Patterson S. H.	Shaw, Gray, Rives.
Camden	Jan. 17	Camden	Gray, Burgess.
Carteret	Jan. 31	Newport	Garren, Hill.
Caswell	July 21	Leasburg	Johnson, Cunningham, Fletcher.
	July 22	Yanceyville	Johnson, Cunningham, Fletcher.
Catawba	Aug. 2	Terrell	Sherman, Browne, French.
	Aug. 4	St. James S. H.	Sherman, Browne, French.
	Aug. 5	Conover	Sherman, Browne, French.
	Aug. 19	Wesley's Chapel Camp Ground	Hendricks, Gray, Nelson.
	Aug. 20	Cloninger's Farm	Hendricks, Gray, Nelson.
	Sept. 15	Claremont	Gray.
Chatham	July 18	Bynum	Sherman, Flowe, H. P., Green.
	July 19	Farrington	Sherman, Flowe, H. P., Green.
	July 21	Goldston	Rives, Eaton, Green.
	July 22	Siler City	Rives, Eaton, Green.
Cherokee	July 21	Murphy	Williams, Curtis, Holmes.
	July 25	Andrews	Williams, Curtis, Holmes.
Chowan	Dec. 20	Edenton	Sherman, Browne.
Clay	July 22	Ogden	Williams, Curtis, Holmes.
	July 23	Elf	Williams, Curtis, Holmes.
	July 24	Hayesville	Williams, Curtis, Holmes.
Cleveland	Mar. 24, 25	Mooresboro	Parker, Eaton.
	Aug. 14	Ellenboro	Sherman, French, Reed.
	Aug. 23	Casar	Sherman, Eaton, Robinson.
Columbus	Jan. 22	Hallsboro	Shaw, Scott.
	Jan. 24	Chadbourn	Shaw, Scott.
	Jan. 25	Tabor	Shaw, Scott.
	Jan. 27	Old Dock	Shaw, Scott.
Craven	Jan. 29	Beech Grove	Garren, Hill.
	Feb. 1	Vanceboro	Garren, Hill.
	Feb. 4	Dover	Garren, Hill.
Cumberland	Feb. 8	Fayetteville	Shaw, Scott, McLean.
	Feb. 10	Stedman	Shaw, Scott, McLean.
	Feb. 11	Wade	Shaw, Scott, McLean.
Currituck	Jan. 14	Currituck C. H.	Gray, Burgess.
	Jan. 15	Jarvisburg	Gray, Burgess.
Dare			
Davidson	July 24	Enterprise	Newman, Cunningham, Rives.
	July 25	Wallburg	Newman, Cunningham, Rives.
	July 26	Tyro	Newman, Cunningham, Rives.
	Aug. 18	Clarskburg	Garren, Roberts, Green.
	Aug. 19	Cedar Springs	Garren, Roberts, Green.
Davie	Aug. 3	Mocksville	Robinson.
	Aug. 8	Center Church	Gray, Robinson, Cunningham.
	Aug. 9	Fork Church	Gray, Robinson, Cunningham.
Duplin	Jan. 21	Concord S. H.	Garren, Hill.
	Jan. 22	Faison	Garren, Hill.
	May 2	Warsaw	Burgess.

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FARMERS' INSTITUTES, 1913.

County	Date	Place	Lecturers
Durham	July 18	Redwood	Johnson, Cunningham, Parker.
Edgecombe	Feb. 3	Speed	Gray, Latham.
	Feb. 5	Whitakers	Gray, Latham.
	Feb. 15	Macclesfield	Garren, Hutt.
	Feb. 22	Brick	Gray, Garren.
	Sept. 12	Test Farm	Graham, Gray, D. T., Garren.
Forsyth	Aug. 7	Rural Hall	Gray, Robinson, Cunningham.
	Aug. 11	Burke's Grove	Gray.
	Aug. 12	Clemmons	Gray.
	Aug. 16	Kernersville	Gray, Shaw, Cunningham.
Franklin	Feb. 15	Franklinton	Gray, Parker.
	Feb. 17	Louisburg	Gray.
	Mar. 1	Louisburg	Gray.
Gaston	Aug. 16	Sunnyside S. H.	Sherman, French.
	Aug. 18	Chapel Church	Sherman, Eaton, Robinson.
	Aug. 20	Stanley	Sherman, Eaton, Robinson.
Gates	Jan. 20	Gatesville	Gray, Eaton.
Graham			
Granville	Feb. 13	Oxford	Gray, Parker.
	Feb. 14	Hester	Parker, Gray.
		Test Farm	Fulton.
Greene	Jan. 25	Snow Hill	Garren, Hill.
Guilford	July 25	Pleasant Garden	Burgess, Eaton, Green.
	Aug. 18	Deep River	Hendricks, Nelson, Cunningham.
	Aug. 19	Battleground	Hendricks, Nelson, Cunningham.
	Aug. 20	McLeansville	Hendricks, Shaw, Cunningham.
	Sept. 1	Colfax	Parker, Gray.
Halifax	Jan. 25	Scotland Neck	Parker, Gray.
	Feb. 7	Weldon	Gray, Latham.
	Feb. 8	Littleton	Gray, Latham.
Harnett	Feb. 12	Dunn	Shaw, Scott, McLean.
Haywood	Aug. 9	Bethel	Hendricks, Millsaps, Holmes.
	Aug. 11	Rock Hill	Hendricks, Millsaps, Holmes.
Henderson	Aug. 5	Green River	Hendricks, Millsaps, Holmes.
	Aug. 7	Mills River	Hendricks, Millsaps, Holmes.
	Aug. 8	Liberty	Hendricks, Millsaps, Holmes.
Hertford	Jan. 21	Winton	Gray, Parker, Eaton.
	Jan. 22	Murfreesboro	Gray, Parker, Eaton.
	Jan. 30	Ahoskie	Gray, Parker.
Hoke	July 21	Raeford	McLean, Gray, Dan T.
Hyde	Dec. 12	Swan Quarter	Parker, Sherman, Browne.
	Dec. 13	Lake Landing	Parker, Sherman, Browne.
	Dec. 14	Fairfield	Parker, Sherman, Browne.
	Dec. 16	Sladesville	Parker, Sherman, Browne.
	Mar. 13, 14	Sladesville	Parker, Sherman.
Iredell	July 28	Mooresville	Garren, Eaton, Shuford.
	Aug. 16	Test Farm	Shuford, Nelson, Gray, D. T.
	Aug. 21	Cool Springs	Hendricks, Gray, D. T., Nelson.
	Aug. 22	Eupeptic Springs	Hendricks, Gray, D. T., Nelson.
Jackson	July 28	Quallatown	Williams, Millsaps, Holmes.
	July 29	Cullowhee	Williams, Millsaps, Holmes.
Johnston	Jan. 13	Woodward S. H.	Garren, Hill.
	Jan. 14	Selma	Garren, Hutt, Hill.
	Jan. 15	Benson	Scott, McLean.
	Mar. 28	Smithfield	Parker, Winston.
Jones	Jan. 27	Pollocksville	Garren, Hill.
	Feb. 6	Trenton	Garren, Hutt, Hill.

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FARMERS' INSTITUTES, 1913.

County	Date	Place	Lecturers
Lee	Aug. 2	Broadway	Gray.
	Aug. 6	Sanford	Garren, McLean, Rives.
Lenoir	Jan. 24	La Grange	Garren, Hill.
	Feb. 3	Kinston	Garren, Hill.
Lincoln	Aug. 21	Iron Station	Sherman, Robinson, Eaton.
	Aug. 22	Reepsville	Sherman, Robinson, Eaton.
	Aug. 25	Triangle	Sherman, Robinson, Eaton.
Macon	July 30	Higdonville	Williams, Millsaps, Holmes.
	July 31	Maxwell's S. H.	Williams, Millsaps, Holmes,
	Aug. 1	Franklin	Williams, Millsaps, Holmes.
	Aug. 2	Otto	Williams, Millsaps, Holmes.
Madison	Aug. 13	Mars Hill	Hendricks, Millsaps, Holmes.
	Aug. 14	Marshall	Hendricks, Millsaps, Holmes.
Martin	Jan. 31	Robersonville	Gray, Latham.
	Feb. 1	Oak City	Gray, Latham.
McDowell	Aug. 12	Marion	Sherman, French, Browne.
	Aug. 15	Old Fort	Hendricks, Millsaps, Holmes.
Mecklenburg	Mar. 26	Charlotte	Parker, Eaton.
	July 31	Arlington	Sherman, Browne, French.
	Aug. 1	Rhyne	Sherman, Browne, French.
	Aug. 19	Dixie	Sherman, Robinson, Eaton.
	July 29	Huntersville	Garren, Eaton, Green.
	Sept. 5	Charlotte	Gray.
Mitchell	Aug. 7	Spruce Pine	Sherman, Browne, French.
	Aug. 11	Bakersville	Sherman, Browne, French.
Montgomery	Aug. 9	Star	Garren, McLean, Rives.
	Aug. 11	Mt. Gilead	Garren, Roberts, Rives.
Moore	July 18	Cameron	Rives, Gray, D. T., McLean.
	July 19	Aberdeen	Rives, Gray, D. T., McLean.
	Aug. 4	West End	Garren, McLean, Rives.
	Aug. 5	Carthage	Garren, McLean, Rives.
	Aug. 7	Glendon	Garren, McLean, Rives.
	Aug. 8	Elise	Garren, McLean, Rives.
Nash	Feb. 4	Nashville	Gray, Latham.
	Feb. 15	Stanhope	Garren, Hutt.
	Sept. 10	Stanhope	Graham, Garren, Gray, D. T.
New Hanover	Jan. 20	Wrightsboro	Shaw, Scott.
Northampton	Jan. 23	Lasker	Parker, Gray, Eaton.
	Jan. 24	Rich Square	Parker, Gray, Eaton.
	Feb. 5	Seaboard	Gray, Latham.
Onslow	Jan. 28	Harris S. H.	Garren, Hill.
	Feb. 5	Richlands	Garren, Hill.
Orange	July 18	Efland	Parker, Hill, Winters.
Pamlico	Jan. 30	Bayboro	Garren, Hill.
Pasquotank	Jan. 16	Elisabeth City	Gray, Burgess.
	Jan. 18	Salem	Gray, Eaton.
Pender	Jan. 21	Burgaw	Shaw, Scott.
	Feb. 5	Atkinson	Shaw, Scott, McLean.
Perquimans	Jan. 13	Hertford	Gray.
Person	July 19	Roxboro	Johnson, Cunningham, Fletcher.
Pitt	Dec. 9	Farmville	Parker, Sherman.
	Feb. 7	Grifton	Garren, Hutt, Hill.
	Feb. 8	Greenville	Garren, Hutt, Hill.
	Feb. 10	Grimesland	Garren, Hutt, Hill.
Polk	Aug. 4	Columbus	Hendricks, Millsaps, Holmes.
Randolph	July 23	Liberty	Burgess, Eaton, Green.
	Aug. 20	Farmer	Garren, Roberts, Rives.
	Aug. 21	Mt. Olivet Academy	Garren, Roberts, Rives.

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FARMERS' INSTITUTES, 1913.

County	Date	Place	Lecturers
Randolph	Aug. 22	Park's X Roads	Garren, Roberts, Rives.
	Aug. 23	Sophia	Garren, Roberts, Rives.
Richmond	July 22	Hoffman	Sherman, Gray, D. T., McLean.
	July 23	Rockingham	Sherman, Gray, D. T., McLean.
Robeson	Jan. 13	Lumber Bridge	Scott.
	Jan. 14	Red Springs	Scott.
	Jan. 16	Lumberton	Scott, Shaw, Millsaps.
	Jan. 18	St. Paul	Scott, Shaw, Millsaps.
	Jan. 23	Fairmont	Shaw, Scott.
Rockingham	July 23	Ruffin	Newman, Cunnigham, Rives.
	Aug. 15	Gold Hill	Gray, Shaw, Cunningham.
Rowan	July 26	Mt. Ulla	Garren, Eaton, Green.
	Aug. 2	China Grove	Garren, Eaton, Green.
	Aug. 15	Liberty S. H	Garren, Roberts, Rives.
	Aug. 16	Rockwell	Garren, Roberts, Rives.
	Aug. 25	Woodleaf	Hendricks, Roberts, Rives.
Rutherford	Aug. 13	Rutherfordton	Sherman, French, Reed.
	Aug. 14	Ellenboro	Sherman, French, Reed.
Sampson	Jan. 20	Clinton	Garren, Hill.
	Feb. 6	Garland	Shaw, McLean.
	Feb. 7	Salemburg	Shaw, Scott, McLean.
	Feb. 13	Newton Grove	Shaw, Scott, McLean.
	Feb. 14	Spring Branch	Shaw, Scott, McLean.
Scotland	Jan. 15	John's Station	Scott.
Stanly	Aug. 12	Big Lick	Garren, Roberts, Rives.
	Aug. 13	Endy, S. H.	Garren, Roberts, Rives.
	Aug. 14	Richfield	Garren, Roberts, Rives.
Stokes	Aug. 13	Walnut Cove	Gray, Shaw, Cunningham.
	Aug. 14	Danbury	Gray, Shaw, Cunningham.
Surry	Aug. 1	Copeland	Newman, Curtis, Cunningham.
	Aug. 4	Pilot Mountain	Newman, Robinson, Cunningham.
	Aug. 5	Westfield	Newman, Robinson, Cunningham.
	Aug. 6	Antioch Church	Gray, Robinson, Cunningham.
	Sept. 29	Piney Grove Church	Gray, Parker.
Swain	July 26	Bryson City	Williams, Curtis, Holmes.
Transylvania	Aug. 6	Selica	Williams, Millsaps, Holmes.
Tyrrell	Dec. 18	Columbia	Sherman, Browne.
Union	July 26	Wingate	Sherman, Gray, D. T., McLean.
	July 28	Waxhaw	Sherman, Browne, McLean.
	July 29	Prospect	Sherman, Browne, McLean.
	July 30	Indian Trail	Sherman, Browne, McLean.
Vance	Feb. 11	Middleburg	Parker, Gray.
	Feb. 12	Bear Pond	Parker, Gray.
	Sept. 9	Henderson	Gray.
Wake	Feb. 19	Zebulon	Garren, Hutt, Graham.
	Aug. 26, 27, 28	Raleigh	Round-up Institute.
Warren	Feb. 8	Littleton	Gray, Latham.
	Feb. 10	Warrenton	Gray, Parker.
Washington	Dec. 10	Plymouth	Parker, Sherman, Browne.
	Dec. 17	Mackey's Ferry	Parker, Sherman, Browne.
	Dec. 19	Creswell	Sherman, Browne.
Watauga	Sept. 18	Valle Crucis	Gray, Shaw, Rives.
	Sept. 19	Boone	Gray, Shaw, Rives.
Wayne	Jan. 15	Hood Swamp	Garren, Hill.
	Jan. 16	Salem Church	Garren, Hill.
	Jan. 17	Falling Creek	Garren, Hill.
	Jan. 18	Smith's Chapel	Garren, Hill.

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FARMERS' INSTITUTES, 1913.

County	Date	Place	Lecturers
Wayne	Jan. 23	Seven Springs	Garren, Hill.
	Sept. 13	Rose	Parker, Garren, Gray, D. T.
Wilkes	July 28	Beaver Creek	Newman, Curtis, Cunningham.
	July 29	Wilkesboro	Newman, Curtis, Cunningham.
	July 30	Ronda	Newman, Curtis, Cunningham.
	Sept. 27	Trap Hill	Gray, Parker, Shaw, Rives.
Wilson	Feb. 15	Stantonsburg	Garren, Hutt.
	Feb. 17	Lucama	Garren, Hutt.
Yadkin	July 31	Yadkinville	Newman, Curtis, Cunningham.
	Aug. 1	Booneville	Newman, Curtis, Cunningham.
Yancey	Aug. 8	Burnsville	Sherman, Browne, French.
	Aug. 9	Bald Creek	Sherman, Browne, French.

LECTURERS AND SUBJECTS.

Name	No. Institutes Attended	Subjects
BROWNE, T. E. District Demonstration Agent.	24	Peanut Culture. Corn Culture.
BURGESS, J. L. Agronomist, Department of Agriculture.	9	Farm Crops. Soil Building.
CUNNINGHAM, J. S.	32	Tobacco Culture.
CURTIS, R. S. Assistant Animal Husbandry.	12	Beef Production.
EATON, W. H. Dairy Expert.	25	Silo and Silage. Care and Feeding of Dairy Cows. Butter Making.
FLOWE, H. P. Assistant Veterinarian.	4	Diseases of Live Stock.
FRENCH, A. L. Farmer.	12	Soil Improvement With Live Stock.
FLETCHER, J. D. Farmer.	4	Corn Culture.
FULTON, DR. R. H. Plant Pathologist, Agricultural and Mechanical College.	1	Plant Diseases.
GARREN, G. M. Assistant Agronomist, Department of Agriculture.	55	Soil Improvement. Corn Culture.
GRAY, JAS. M. Assistant Director of Farmers' Institutes, Department of Agriculture.	57	Legumes as Soil Improvers. Soil Management. Corn Culture. Seed Selection.
GRAY, DAN T. Chief of Animal Husbandry, Department of Agriculture.	18	Hog Growing.
GREEN, E. L.	15	Chicken Growing.
HENDRICKS, M. J. Farmer.	15	Wheat Culture. Corn Culture.
HILL, R. G. Assistant Horticulturist.	27	Apple Culture. Vegetable Gardens.
HOLMES, J. State Forester.	21	Forest Protection.

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LECTURERS AND SUBJECTS.

Name	No. Institutes Attended	Subjects
HUTT, W. N. State Horticulturist, Department of Agriculture.	12	Pecan Growing. Orchard Management.
JOHNSON, J. M. Expert in Farm Management, U. S. Department of Agriculture.	5	Farm Management.
LATHAM, J. Farmer.	12	Crop Rotation.
McLEAN, T. D. District Demonstration Agent.	19	Cotton Growing. Soil Improvement.
MEACHAM, F. T. Superintendent Test Farm.	3	
MILLSAPS, E. S. District Demonstration Agent.	15	Corn Culture. Cotton Culture.
NELSON, O. A. Farmer.	8	Cooperation.
NEWMAN, C. L. Professor of Agriculture, Agricultural and Mechanical College.	12	Soil Improvement. Cotton Culture. Commercial Fertilizers.
PARKER, T. B. Director of Farmers' Institutes, Department of Agriculture.	36	Commercial Fertilizers. Corn and Cotton Culture. Soil Building.
SHAW, S. B. Assistant Horticulturist, Department of Agriculture.	42	Apple Culture. Spraying and Spray Materials.
SHERMAN, FRANKLIN, JR. State Entomologist, Department of Agriculture.	40	Insect Pests and their Control.
SCOTT, R. W. Farmer.	22	Live Stock on the Farm. Farm Management.
SHUFORD, W. J.	4	Cooperation.
RIVES, J. R. Farmer.	31	Cooperation.
REED, A. J. Dairy Specialist, U. S. Department of Agriculture.	7	Dairying.
ROBERTS, DR. G. A. College Veterinarian, Agricultural and Mechanical College.	15	Diseases of Live Stock.
ROBINSON, JOHN. Farmer.	15	Dairying. Cooperation.
WILLIAMS, C. B. Assistant Director Experiment Station, Department Agriculture.	15	Farm Crops. Lime and its Use.
WINSTON, R. Assistant Pathologist, Agricultural and Mechanical College.	1	Plant Diseases.
WINTERS.	2	Cotton Growing.

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County and Local Farmers' Institute Organizations.

Farmers' Institute Committees are appointed in all the counties where institutes are held. The duties of the members of the committees are to suggest places where the institutes are to be held, topics for discussion, advertise the meetings, look after the comfort of those attending the meetings, see that the house or hall in which the institute is to be held is put in good order before the hour for the institute to meet.

Farmers' clubs, local Farmers' Alliances, and local Farmers' Unions can greatly help the institutes by coöperating with the local institute committees and the conductor of the institute party. Such coöperation is welcomed.

CHAIRMEN OF COUNTY AND LOCAL FARMERS' INSTITUTE COMMITTEES.

County	Chairman of Committee	Postoffice
Alamance	Chas. R. Cates	Mebane.
Elon College	W. P. Lawrence	Elon College.
Oakdale	W. A. Lineberry	Liberty.
Alexander	J. H. Smith	Taylorsville.
Alleghany	S. F. Thompson	Walls.
Anson	Dr. W. J. McLendon	Wadesboro.
Peachland	H. M. Baucom	Peachland
Ashe	John Dent	Jefferson.
Scottsville	Ed. Shepherd	Scottsville.
Beaufort	W. D. Grimes	Washington.
Bath	J. B. Archbell	Bath.
Bertie	C. W. Spruill	Quitsna.
Mars Hill	Josiah Brown	Coleraine.
Bladen	R. B. Cromartie	Elizabethtown.
Council	T. A. Jones	Zara.
Tarheel	S. P. Metcalf	Tarheel.
Clarkton	E. J. Cox	Clarkton.
Abbottsburg	F. S. Averitt	Abbottsburg.
Brunswick	Jack Johnson	Winnabow.
Ash	R. M. Long	Ash.
Shallotte	E. M. Parker	Shallotte.
Supply	W. Sellers	Supply.
Cool Run S. H.	J. M. Hewett	Shallotte.
Buncombe	R. P. Hayes	Asheville.
Democrat	S. H. Carter	Democrat.
Swannanoa	R. W. Collett	Swannanoa.
Burke	J. M. Coulter	Connelly Springs.
Glen Alpine	John Houck	Glen Alpine.
Hickory Grove	J. A. Lackey	Morganton, No. 5.
Cabarrus	A. H. Litaker	Concord.
Harrisburg	C. L. Sims	Harrisburg.
Mt. Pleasant	W. H. Fisher	Mt. Pleasant.
Caldwell	G. M. Goforth	Lenoir.
Oak Hill	D. C. Flowers	Lenoir, No. 2.
Camden	W. G. Ferebee	Gregory.
Carteret	D. N. McCain	Newport.
Caswell	J. F. Walters	Blanche.
Leasburg	E. W. Lea	Leasburg.
Catawba	John Robinson	Hickory.
Claremont	J. A. Arndt	Claremont.
Wesley's Chapel	R. O. Ramseur	Hickory, No. 1.
Cloninger's Farm	C. F. Bowman	Hickory, No. 2.
Newton	C. E. Smyre	Newton.
Conover	Adrian Shuford	Conover.

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CHAIRMEN OF COUNTY AND LOCAL FARMERS' INSTITUTE COMMITTEES.

County	Chairman of Committee	Postoffice
Chatham	J. E. Womble	Apex, No. 4.
Bynum	R. L. Ward	Riggsbee.
Goldston	I. P. Coggins	Bear Creek.
Siler City	Geo. Womble	Siler City.
Cherokee	G. B. Walker	Andrews.
Murphy	B. M. Ledford	Ranger.
Andrews	D. W. Whisenhunt	Andrews.
Chowan	Z. W. Evans	Tyner.
Clay	W. T. Bumgarner	Hayesville.
Brasstown	Carl Scroggs	Brasstown.
Ogden	G. S. McClure	Ogden.
Elf	W. A. Cassada	Hayesville, No. 1.
Cleveland	J. T. Gardner	Shelby.
Casar	A. A. Warlick	Casar.
Columbus	D. Boughner	Chadbourn.
Tabor	Minos Meares	Tabor.
Whiteville	Dr. W. Ross Davis	Whiteville.
Old Dock	C. W. Suggs	Old Dock.
Hallsboro	J. A. Wyche	Hallsboro.
Craven	W. H. Bray	New Bern.
Vanceboro	O. McLawhorne	Vanceboro.
Beech Grove	G. T. Richardson	New Bern.
Cumberland	W. H. Downing	Fayetteville.
Stedman	R. S. Autry	Stedman.
Currituck	J. J. Ferebee	Shawboro.
Davidson	P. J. Leonard	Lexington.
Clarksburg	T. R. Hundley	Lexington, No. 2.
Cedar Springs	J. R. Crouse	Cid.
Wallburg	A. W. Yokley	Winston-Salem, No. 5.
Tyro	C. F. Koonts	Linwood, No. 1.
Welcome	J. C. Ripple	Lexington, No. 4.
Thomasville	J. W. Lambeth	Thomasville.
Davie	S. A. Woodruff	Mocksville.
Center Church	E. B. Barneycastle	Mocksville, No. 5.
Fork Church	W. F. Merrill	Mocksville, No. 3.
Duplin	J. A. Shine	Faison.
Calypso	J. T. Albritton	Mt. Olive.
Rose Hill	Maury Ward	Rose Hill.
Faison	H. J. Faison	Faison.
Durham	E. J. Parrish	Durham.
Edgecombe	G. T. DeBerry	Tarboro.
Conetoe	N. B. Dawson	Conetoe.
Whitakers	M. J. Battle	Whitakers.
Forsyth	A. B. Atwood	Winston-Salem.
Rural Hall	J. E. Fowler	Rural Hall.
Burke Grove	P. E. Burke	Winston-Salem, No. 1.
Clemmons	T. W. Griffith	Clemmons.
Kernersville	N. H. Smith	Kernersville.
Franklin	T. B. Wilder	Louisburg.
Franklinton	J. C. Winston	Franklinton.
Gaston	E. D. Thompson	Stanley.
Sunnyside School	H. S. Sellers	Kings Mountain.
Chapel Church	E. A. Hurley	Gastonia.
Gates	W. J. Boone	Drum Hill.
Granville	E. G. Moss	Creedmoor.
Stovall	C. L. Lewis	Stovall.
Creedmoor	C. H. Cozart	Creedmoor.
Greene	W. R. Dixon	Snow Hill.
Grimsley's Church	J. T. Dixon	Farmville.

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CHAIRMEN OF COUNTY AND LOCAL FARMERS' INSTITUTE COMMITTEES.

County	Chairman of Committee	Postoffice
Guilford	J. G. Frazier	Guilford College.
Deep River	W. L. Kivett	High Point.
McLeansville	Junius Boon	McLeansville.
Pleasant Garden	C. E. Hockart	Pleasant Garden.
Colfax	W. L. Gibbons	Colfax.
Halifax	J. H. Sherrod	Enfield.
Scotland Neck	G. W. Bryan	Scotland Neck.
Littleton	Claud Sessoms	Littleton.
Harnett	C. McArtan	Littleton.
Coats	T. D. Stewart	Coats.
Duke	A. F. Fowler	Duke.
Haywood	Dr. G. D. Green	Waynesville.
Bethel	M. D. Kinsland	Waynesville, No. 3.
Rock Hill	Jurvis H. Allison	Dellwood.
Canton	E. G. P. Murry	Canton.
Henderson	J. P. Fletcher	Fletcher.
Green River S. H.	J. W. Ward	Zirconia.
Mills River S. H.	M. M. Britton	Horse Shoe.
Dana	Samuel Rau	Hendersonville, No. 1
Liberty	R. A. McKillop	Hendersonville.
Hertford	W. P. Shaw	Winton.
Ahoskie	A. E. Garrett	Ahoskie.
Hoke	J. H. Campbell	Raeford.
Hyde	Chas. Brim	Swan Quarter.
Middletown	J. S. Mann	Middletown.
Iredell	J. W. Sherrill	Statesville, No. 6.
Cool Springs	W. F. Reece	Statesville, No. 7.
Eupeptic Springs	J. K. Patterson	Statesville, No. 2.
Mooresville	T. J. Williams	Mooresville.
Jackson	Prof. Frank H. Brown	Cullowhee.
Quallatown	J. E. Rogers	Whittier.
Johnston	W. M. Saunders	Smithfield.
Kenly	L. B. Boyette	Kenly.
Benson	J. F. Lee	Benson.
Jones	T. C. Whitaker	Trenton.
Pollocksville	A. H. White	Pollocksville.
Lee	J. R. Rives	Sanford.
Lenoir	G. F. Loftin	Kinston.
Seven Springs	G. G. Quinn	Seven Springs.
LaGrange	J. E. Jones	LaGrange.
Lincoln	H. S. Robinson	Lincolnton.
Triangle	J. H. Nixon	Stanley.
McDowell	E. S. Frisbie	Marion.
Old Fort	J. L. Burgin	Old Fort.
Macon	Arthur Siler	Franklin.
Maxwell S. H.	C. B. Yeargan	Franklin, No. 1.
Otto	D. T. Cabe	Otto.
Higdonville	Parker Moore	Higdonville.
Madison	L. M. Bryan	Marshall.
Mars Hill	A. F. Sprinkle	Mars Hill.
Martin	P. R. Rives	Robersonville.
Oak City	N. M. Worsley	Oak City.
Mecklenburg	C. C. Moore	Charlotte.
Huntersville	A. B. McAuley	Huntersville.
Derita	B. J. Hunter	Derita.
Mitchell	Jos. Bowditch	Toecane.
Spruce Pine	N. S. Lawrence	Spruce Pine.

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CHAIRMEN OF COUNTY AND LOCAL FARMERS' INSTITUTE COMMITTEES.

County	Chairman of Committee	Postoffice
Montgomery	O. B. Deaton	Troy.
Star	G. N. Scarboro	Star.
Mt. Gilead	R. A. Bruton	Mt. Gilead.
Moore	T. D. McLean	Carthage.
West End	W. P. Cochrane	West End.
Glendon	A. J. Jones	Glendon.
Hemp	J. C. Monroe	Eagle Springs.
Cameron	H. P. McPherson	Cameron.
Nash	S. F. Austin	Nashville.
Stanhope High S.	S. H. Brantley	Spring Hope.
New Hanover	Wm. Gregerson	Castle Hayne.
Northampton	J. W. Jessup	Rich Square.
Rich Square	W. E. Spivey	Rich Square.
Lasker	C. S. Lasker	Lasker.
Onslow	Dr. J. L. Nicholson	Richlands.
Richlands	J. M. Franck	Richlands.
Orange	A. H. Rimmer	Hillsboro.
Pamlico	G. T. Farnell	Bayboro.
Pasquotank	R. N. Morgan	Elizabeth City.
Weeksville	H. M. Pritchard	Weeksville.
Pender	W. M. Hand	Burgaw.
Atkinson	Geo. J. Moore	Atkinson.
Perquimans	M. H. White	Hertford.
Person	C. B. Brooks	Roxboro.
Pitt	J. F. Evans	Greenville.
Grimesland	Alston Grimes	Grimesland.
Grifton	J. C. Gaskins	Grifton.
Polk	T. T. Ballinger	Tryon.
Randolph	John Beeson	Asheboro.
Liberty	J. M. Williams	Liberty.
Mt. Olivet Academy	W. M. Moffitt	Moffitt.
Parks Cross Roads	J. O. Forester	Ramseur.
Randleman	Will Lassiter	Randleman.
Richmond	W. C. Leak	Rockingham.
Ellerbe	E. L. Pegram	Ellerbe.
Robeson	J. A. McAllister	Lumberton.
Parkton	W. S. Cobb	Parkton.
St. Paul	G. M. D. Howard	St. Paul.
Lumber Bridge	Neil Shaw	Lumber Bridge.
Fairmont	N. T. Andrews	Fairmont.
Red Springs	J. D. McLean	Red Springs.
Rockingham	J. V. Price	Madison.
Gold Hill	J. P. Wilson	Madison.
Ruffin	B. L. Blackwell	Pelham.
Leaksville	J. J. Thomas	Leaksville.
Appler	R. L. Pearson	Reidsville, No. 1.
Rowan	T. D. Brown	Salisbury.
China Grove	M. A. Stirewalt	China Grove.
Liberty S. H.	A. N. Trexler	Gold Hill, No. 1.
Rockwell	C. M. Fisher	Rockwell.
Mt. Ulla	J. K. Goodman	Mt. Ulla.
Rutherford	J. M. Jones	Rutherfordton.
Ellenboro	G. S. Harrill	Ellenboro.
Sampson	S. H. Hobbs	Clinton.
Newton Grove	J. W. Bryan	Newton Grove.
Roseboro	D. W. Culbreth	Roseboro.
Garland	J. D. Johnson	Garland.
Spring Branch	W. A. Jackson	Cooper.

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CHAIRMEN OF COUNTY AND LOCAL FARMERS' INSTITUTE COMMITTEES.

County	Chairman of Committee	Postoffice
Scotland	W. N. McKenzie	Gibson.
Stanly	G. T. Dunlap	Norwood.
Richfield	E. D. Coggins	New London.
Endy S. H.	W. A. Harward	Bridgeport.
Stokes	I. G. Ross	Walnut Cove.
Walnut Cove	Chap. Bodenheimer	Germanton.
Surry	S. C. Franklin	Mt. Airy.
Piney Grove Church	J. L. Jackson	Mt. Airy.
Copeland	Jos. Osborne	Rockford.
Mt. Airy	W. J. Herring	Mt. Airy.
Pilot Mountain	D. J. Denney	Pinnacle.
Swain	R. L. Sandidge	Bryson City.
Transylvania	W. H. Grogan	Brevard.
Selica	C. C. Duckworth	Selica.
Tyrrell	W. W. Sawyer	Columbia.
Union:		
Indian Trail	J. W. Rollins	Indian Trail.
Prospect	S. A. Latham	Monroe, No. 4.
Waxhaw	E. G. Yarborough	Waxhaw.
Wingate	Dr. J. R. Jerome	Wingate.
Vance	J. B. Allen	Henderson, No. 4.
Middleburg	J. K. Plummer	Middleburg.
Wake	W. B. Upchurch	Apex.
Zebulon	W. H. Chamblee, Jr.	Zebulon.
Warren	H. T. Macon	Warrenton.
Wise	P. R. Perkinson	Wise.
Washington	T. W. Blount	Roper.
Creswell	W. T. Hopkins	Creswell.
Watauga	J. C. Horton	Boone.
Wayne	H. D. Ham	Goldsboro.
Smith Chapel	W. B. Hood	Mt. Olive.
Pikeville	E. T. Crawford	Pikeville.
Hood Swamp	J. F. Smith	Aaron.
Falling Creek	T. I. Sutton	Goldsboro, No. 4.
Wilkes	A. G. Hendren	Straw.
Trap Hill	M. A. Bryan	Trap Hill.
Wilson	E. B. Dean	Wilson.
Yadkin	A. S. Speer	Booneville.
Yancey	E. F. Watson	Burnsville.

STATE FARMERS' CONVENTION.

S. H. Hobbs	President	Clinton, N. C.
T. E. Browne	Secretary	West Raleigh, N. C.

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WOMEN'S INSTITUTES, 1913

This is the first year we have ever held as many institutes in the State for women as we have for men. With each year interest and number in attendance increase. This is well. Someone has very truthfully said that "The home is the center of all life and that woman is the center of the home." This being true we can most effectively reach the people of the community through the women, therefore, it is well that we shall support with all diligence this feature of our institute work.

The first Women's Institutes held in the State were in 1906, when 21 institutes were held in 19 counties. Since then they have grown in numbers and attendance each year until this year we held 260 Women's Institutes in 97 counties and with a total attendance of 23,007.

The following is a partial list of the subjects discussed at the Women's Institutes:

Health Hints.
Care of the Sick.
Care of Infants.
What to do Until the Doctor Comes.
Home Nursing.
Home Sanitation.
Bread Making.
School Lunches.
Best Methods of Cooking.
The Fireless Cooker.
Household Conveniences.
Child Training.
Invalid Cookery.
Time-saving Appliances.
Preventable Diseases.
Insect Pests.
The Home Garden.
The Country Woman and Her Relations to the Home and Community.
The Country Home.
Country Women's Organizations, etc.

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WOMEN'S INSTITUTES, 1913.

County	Date	Location	Lecturers
Alamance	July 24	Oakdale	Miss Hudgins, Miss Carpenter.
	Aug. 21	Elon College	Mrs. Hollowell, Miss Ward.
	Aug. 22	Maywood Academy	Mrs. Hollowell, Miss Ward.
	Aug. 23	Friendship H. S.	Mrs. Hollowell, Miss Ward.
	Aug. 25	Hawfields S. H.	Mrs. Hollowell, Miss Ward.
Alexander	Aug. 23	Taylorsville	Mrs. Whitted, Miss Mahler.
Alleghany	Sept. 25	Sparta	Miss Webb, Mrs. Slagle.
	Sept. 26	Glade Valley S. H.	Miss Webb, Mrs. Slagle.
Anson	July 24	Wadesboro	Mrs. Hutt, Miss White.
	July 25	Peachland	Mrs. Hutt, Miss White.
Ashe	Sept. 22	Jefferson	Miss Webb, Mrs. Slagle.
	Sept. 23	Grassy Creek	Miss Webb, Mrs. Slagle.
	Sept. 24	Scottsville	Miss Webb, Mrs. Slagle.
Avery			
Beaufort	Dec. 10	Pantego	Mrs. McKimmon, Mrs. Cunningham.
	Feb. 11	Bath	Mrs. Hutt, Miss Ward.
	Feb. 12	Aurora	Mrs. Hutt, Miss Ward.
	Feb. 13	Washington	Mrs. Hutt, Miss Ward.
Bertie	Jan. 27	Aulander	Mrs. Hollowell, Miss Mahler.
	Jan. 28	Mars Hill	Mrs. Hollowell, Miss Mahler.
	Jan. 29	Windsor	Mrs. Hollowell, Miss Mahler.
Bladen	Jan. 17	Dublin	Mrs. McKimmon, Mrs. Cunningham.
	Feb. 3	Council	Mrs. Cunningham.
	Feb. 4	Abbottsburg	Mrs. McKimmon, Mrs. Cunningham.
Brunswick	Jan. 28	Ash	Miss Ward, Mrs. Cunningham.
	Jan. 29	Cool Run S. H.	Miss Ward, Mrs. Cunningham.
	Jan. 30	Supply	Miss Ward, Mrs. Cunningham.
	Jan. 31	Bolivia	Miss Ward, Mrs. Cunningham.
	Feb. 1	Winnabow	Miss Ward, Mrs. Cunningham.
Buncombe	Aug. 12	Democrat	Mrs. Whitted, Miss Mahler.
	Aug. 18	Swannanoa	Mrs. Whitted, Miss Mahler.
Burke	Aug. 6	Hildebrand	Mrs. Hutt, Miss Clement.
	Aug. 16	Hickory Grove S. H.	Mrs. Whitted, Miss Mahler.
Cabarrus	July 30	Harrisburg	Miss Hudgins, Miss Carpenter.
	July 31	Mt. Pleasant	Miss Hudgins, Miss Carpenter.
	Aug. 1	Concord	Miss Hudgins, Miss Carpenter.
Caldwell	Sept. 15	Granite Falls	Miss Webb, Mrs. Slagle.
	Sept. 16	Oak Hill	Miss Webb, Mrs. Slagle.
	Sept. 17	Patterson School	Miss Webb, Mrs. Slagle.
Camden	Jan. 17	Camden C. H.	Mrs. Whitted, Miss Mahler.
Carteret	Jan. 31	Newport	Mrs. Hutt.
Caswell	July 21	Leasburg	Mrs. Hollowell, Miss Phelps.
	July 22	Yanceyville	Mrs. Hollowell, Miss Phelps.
Catawba	Aug. 2	Terrell	Mrs. Hutt, Miss White.
	Aug. 4	St. James S. H.	Mrs. Hutt, Miss White.
	Aug. 5	Conover	Mrs. Hutt, Miss White.
	Aug. 19	Wesley's Chapel Camp Ground	Mrs. Whitted, Miss Mahler.
	Aug. 20	Cloninger's Farm	Mrs. Whitted, Miss Mahler.
	Sept. 15	Claremont	Miss Webb, Mrs. Slagle.
Chatham	July 18	Bynum	Miss Hudgins, Miss Carpenter.
	July 19	Farrington	Miss Hudgins, Miss Carpenter.
	July 21	Goldston	Miss Hudgins, Miss Carpenter.
	July 22	Siler City	Miss Hudgins, Miss Carpenter.
Cherokee	July 21	Murphy	Miss Parker, Miss Mahler.
	July 25	Andrews	Miss Parker, Miss Mahler.
Chowan	Dec. 20	Edenton	Mrs. McKimmon, Mrs. Cunningham.

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WOMEN'S INSTITUTES, 1913.

County	Date	Location	Lecturers
Clay	July 22	Ogden	Miss Parker, Miss Mahler.
	July 23	Elf	Miss Parker, Miss Mahler.
	July 24	Hayesville	Miss Parker, Miss Mahler.
Cleveland	Aug. 15	Shelby	Mrs. Hutt, Miss Clement.
	Aug. 23	Casar	Mrs. Hutt, Miss Clement.
Columbus	Jan. 22	Hallsboro	Mrs. McKimmon, Mrs. Cunningham.
	Jan. 24	Chadbourn	Mrs. McKimmon, Mrs. Cunningham.
	Jan. 25	Tabor	Mrs. McKimmon, Mrs. Cunningham.
	Jan. 27	Old Dock	Mrs. Cunningham.
Craven	Jan. 29	Beech Grove S. H.	Mrs. Hutt.
	Feb. 1	Vanceboro	Mrs. Hutt.
	Feb. 4	Dover	Mrs. Hutt, Miss Ward.
Cumberland	Feb. 3	Fayetteville	Mrs. McKimmon, Mrs. Cunningham.
	Feb. 10	Stedman	Mrs. McKimmon, Mrs. Cunningham.
	Feb. 11	Wade	Mrs. McKimmon, Mrs. Cunningham.
Currituck	Jan. 14	Currituck C. H.	Mrs. Whitted, Miss Mahler
	Jan. 15	Jarvisburg	Mrs. Whitted, Miss Mahler.
Dare			
Davidson	July 19	Kennedy S. H.	Miss Parker, Miss Mahler.
	July 24	Enterprise	Mrs. Hollowell, Miss Phelps.
	July 25	Wallburg	Mrs. Hollowell, Miss Phelps.
	July 26	Tyro	Mrs. Hollowell, Miss Phelps.
	Aug. 18	Clarksburg	Miss Hudgins, Miss Capps.
	Aug. 19	Cedar Springs S. H.	Miss Hudgins, Miss Capps.
Davie	Aug. 8	Center Church	Mrs. Hollowell, Miss Ward.
	Aug. 9	Fork Church	Mrs. Hollowell, Miss Ward.
Duplin	Jan. 21	Concord S. H.	Mrs. Hutt, Mrs. Ward.
	Jan. 22	Faison	Mrs. Hutt, Miss Ward.
Durham	July 18	Redwood S. H.	Mrs. Hollowell, Miss Phelps.
Edgecombe	Feb. 3	Speed	Mrs. Hollowell, Miss Mahler.
	Feb. 5	Whitakers	Mrs. Hollowell, Miss Mahler.
	Feb. 15	Macclesfield	Mrs. Hutt, Miss Ward.
	Feb. 22	Brick School	Mrs. Hollowell, Miss Mahler.
	Sept. 11	Test Farm	Mrs. McKimmon, Mrs. Henley.
	Sept. 13	Tarboro	Mrs. McKimmon.
Forsyth	Aug. 7	Rural Hall	Mrs. Hollowell, Miss Ward.
	Aug. 11	Burke's Grove	Mrs. Hollowell, Miss Ward.
	Aug. 12	Clemmons	Mrs. Hollowell, Miss Ward.
	Aug. 16	Kernersville	Mrs. Hollowell, Miss Ward.
Franklin	Feb. 15	Franklinton	Mrs. Hollowell, Miss Mahler.
	Feb. 17	Louisburg	Mrs. Hollowell, Miss Mahler.
	----------	Mapleville	Mrs. McKimmon.
	----------	Inglehart	Mrs. McKimmon.
Gaston	Aug. 16	Sunnyside S. H.	Mrs. Hutt, Miss Clement.
	Aug. 18	Chapel Church	Mrs. Hutt, Miss Clement.
	Aug. 20	Stanley	Mrs. Hutt, Miss Clement.
Gates	Jan. 20	Gatesville	Mrs. Whitted, Miss Mahler.
Graham			
Granville	Feb. 13	Oxford	Mrs. Hollowell, Miss Mahler.
	Feb. 14	Hester	Mrs. Hollowell, Miss Mahler.
	----------	Test Farm	Mrs. McKimmon.
Greene	Jan. 25	Snow Hill	Mrs. Hutt.
Guilford	July 25	Pleasant Garden	Miss Hudgins, Miss Carpenter.
	Aug. 18	Deep River	Mrs. Hollowell, Miss Ward.
	Aug. 19	Battleground	Mrs. Hollowell, Miss Ward.
	Aug. 20	McLeansburg	Mrs. Hollowell, Miss Ward.
	Sept. 1	Colfax	Miss Webb, Mrs. Slagle.

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WOMEN'S INSTITUTES, 1913.

County	Date	Location	Lecturers
Halifax	Jan. 25	Scotland Neck	Mrs. Whitted. Miss Mahler.
	Feb. 7	Weldon	Mrs. Hollowell, Miss Mahler.
	Feb. 8	Littleton	Mrs. Hollowell, Miss Mahler.
Harnett	Feb. 12	Dunn	Mrs. McKimmon, Mrs. Cunningham.
Haywood	Aug. 9	Bethel	Miss Mahler, Mrs. Whitted.
	Aug. 11	Rock Hill	Miss Mahler, Mrs. Whitted.
Henderson	Aug. 5	Green River	Miss Mahler, Mrs. Whitted.
	Aug. 7	Mills River	Miss Mahler, Mrs. Whitted.
	Aug. 8	Liberty S. H.	Miss Mahler, Mrs. Whitted.
Hertford	Jan. 21	Winton	Miss Mahler, Mrs. Whitted.
	Jan. 22	Murfreesboro	Miss Mahler, Mrs. Whitted.
	Jan. 30	Ahoskie	Mrs. Hollowell, Miss Mahler.
Hoke	July 21	Raeford	Mrs. Hutt, Miss White.
Hyde	Dec. 12	Swan Quarter	Mrs. McKimmon, Mrs. Cunningham.
	Dec. 13	Lake Landing	Mrs. McKimmon, Mrs. Cunningham.
	Dec. 14	Fairfield	Mrs. McKimmon, Mrs. Cunningham.
	Dec. 16	Sladesville	Mrs. McKimmon, Mrs. Cunningham.
	Mar. 13-14	Sladesville	Mrs. McKimmon, Miss Mahler.
Iredell	July 28	Mooresville	Miss Hudgins, Miss Crapenter.
	Aug. 16	Iredell Test Farm	Mrs. McKimmon, Mrs. Orr.
	Aug. 21	Cool Springs	Miss Mahler, Mrs. Whitted.
	Aug. 22	Eupeptic Springs	Miss Mahler, Mrs. Whitted.
Jackson	July 28	Quallatown	Miss Parker, Miss Mahler.
	July 29	Cullowhee	Miss Parker, Miss Mahler.
Johnston	Jan. 13	Woodward S. H.	Mrs. Hutt, Miss Ward.
	Jan. 14	Selma	Mrs. Hutt, Miss Ward.
	Jan. 15	Benson	Mrs. Hutt, Miss Ward.
	Mar. 28	Smithfield	Mrs. McKimmon, Miss Mahler.
Jones	Jan. 27	Pollocksville	Mrs. Hutt.
	Feb. 6	Trenton	Mrs. Hutt, Miss Ward.
Lee	Aug. 6	Sanford	Miss Hudgins, Miss Capps.
Lenoir	Jan. 24	La Grange	Mrs. Hutt, Miss Ward.
	Feb. 3	Kinston	Mrs. Hutt, Miss Ward.
Lincoln	Aug. 21	Iron Station	Mrs. Hutt, Miss Clement.
	Aug. 22	Reepsville	Mrs. Hutt, Miss Clement.
	Aug. 25	Triangle	Mrs. Hutt, Miss Clement.
Macon	July 30	Higdonville	Miss Parker, Miss Mahler.
	July 31	Maxwell's S. H.	Miss Parker, Miss Mahler.
	Aug. 1	Franklin	Miss Parker, Miss Mahler.
	Aug. 2	Otto	Miss Parker, Miss Mahler.
Madison	Aug. 13	Mars Hill	Miss Mahler, Mrs. Whitted.
	Aug. 14	Marshall	Miss Mahler, Mrs. Whitted.
Martin	Jan. 31	Robersonville	Mrs. Hollowell, Miss Mahler.
	Feb. 1	Oak City	Mrs. Hollowell, Miss Mahler.
McDowell	Aug. 12	Marion	Mrs. Hutt, Miss Clement.
	Aug. 15	Old Fort	Miss Mahler, Mrs. Whitted.
Mecklenburg	July 29	Huntersville	Miss Hudgins, Miss Carpenter.
	July 31	Arlington	Mrs. Hutt, Miss White.
	Aug. 1	Rhyne	Mrs. Hutt, Miss White.
	Aug. 19	Dixie	Mrs. Hutt, Miss Clement.
	Sept. 5	Charlotte	Mrs. Orr.
Mitchell	Aug. 7	Spruce Pine	Mrs. Hutt, Miss Clement.
	Aug. 11	Bakersville	Mrs. Hutt, Miss Clement.
Montgomery	Aug. 9	Star	Miss Hudgins, Miss Capps.
	Aug. 11	Mt. Gilead	Miss Hudgins, Miss Capps.
Moore	July 18	Cameron	Mrs. Whitted, Miss White.
	July 19	Aberdeen	Mrs. Whitted, Miss White.

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WOMEN'S INSTITUTES, 1913.

County	Date	Location	Lecturers
Moore	Aug. 4	West End	Miss Hudgins, Miss Carpenter.
	Aug. 5	Carthage	Miss Hudgins, Miss Carpenter.
	Aug. 7	Glendon	Miss Hudgins, Miss Capps.
	Aug. 8	Elise	Miss Hudgins, Miss Capps.
Nash	Feb. 4	Nashville	Mrs. Hollowell, Miss Mahler.
	Feb. 18	Stanhope S. H.	Mrs. Hutt, Miss Ward.
	Sept. 11	Stanhope S. H.	Mrs. McKimmon, Mrs. Henley.
New Hanover	Jan. 20	Wrightsboro	Mrs. McKimmon, Mrs. Cunningham.
Northampton	Jan. 23	Lasker	Mrs. Hollowell, Miss Mahler.
	Jan. 24	Rich Square	Mrs. Whitted, Miss Mahler.
	Feb. 6	Seaboard	Mrs. Hollowell, Miss Mahler.
Onslow	Jan. 28	Harris S. H.	Mrs. Hutt.
	Feb. 5	Richlands	Mrs. Hutt, Miss Ward.
Orange	July 18	Efland	Miss Parker, Miss Mahler.
Pamlico	Jan. 30	Bayboro	Mrs. Hutt.
Pasquotank	Jan. 16	Elisabeth City	Mrs. Whitted, Miss Mahler.
	Jan. 18	Salem	Mrs. Whitted, Miss Mahler.
Pender	Jan. 21	Burgaw	Mrs. McKimmon, Mrs. Cunningham.
	Feb. 5	Atkinson	Mrs. McKimmon, Mrs. Cunningham.
Perquimans	Jan. 13	Hertford	Mrs. Whitted, Miss Mahler.
Person	July 19	Roxboro	Mrs. Hollowell, Miss Phelps.
Pitt	Dec. 9	Farmville	Mrs. McKimmon, Mrs. Cunningham.
	Feb. 7	Grifton	Mrs. Hutt, Miss Ward.
	Feb. 8	Greenville	Mrs. Hutt, Miss Ward.
	Feb. 10	Grimesland	Mrs. Hutt, Miss Ward.
Polk	Aug. 4	Columbus	Miss Mahler, Mrs. Whitted.
Randolph	July 23	Liberty	Miss Hudgins, Miss Carpenter.
	Aug. 20	Farmer	Miss Hudgins, Miss Capps.
	Aug. 21	Mt. Olivet Academy	Miss Hudgins, Miss Capps.
	Aug. 22	Park's X Roads	Miss Hudgins, Miss Capps.
	Aug. 23	Sophia	Miss Hudgins, Miss Capps.
Richmond	July 22	Hoffman	Mrs. Hutt. Miss White.
	July 23	Rockingham	Mrs. Hutt. Miss White.
Robeson	Jan. 13	Lumber Bridge	Mrs. McKimmon, Mrs. Cunnignham.
	Jan. 14	Red Springs	Mrs. McKimmon, Mrs. Cunningham.
	Jan. 16	Lumberton	Mrs. McKimmon, Mrs. Cunningham.
	Jan. 18	St. Paul	Mrs. McKimmon, Mrs. Cunningham.
	Jan. 23	Fairmont	Mrs. McKimmon, Mrs. Cunningham.
Rockingham	July 23	Ruffin	Mrs. Hollowell, Miss Phelps.
	Aug. 15	Gold Hill	Mrs. Hollowell, Miss Ward.
Rowan	July 26	Mt. Ulla	Miss Hudgins, Miss Carpenter.
	Aug. 2	China Grove	Miss Hudgins, Miss Carpenter.
	Aug. 15	Liberty S. H.	Miss Hudgins, Miss Capps.
	Aug. 16	Rockwell	Miss Hudgins, Miss Capps.
	Aug. 25	Woodleaf	Miss Mahler, Mrs. Whitted.
Rutherford	Aug. 13	Rutherfordton	Mrs. Hutt, Miss Clement.
	Aug. 14	Ellenboro	Mrs. Hutt, Miss Clement.
Sampson	Jan. 20	Clinton	Mrs. Hutt, Miss Ward.
	Feb. 6	Garland	Mrs. McKimmon, Mrs. Cunningham.
	Feb. 7	Salemburg	Mrs. McKimmon, Mrs. Cunningham.
	Feb. 13	Newton Grove	Mrs. McKimmon, Mrs. Cunningham.
	Feb. 14	Spring Branch	Mrs. McKimmon, Mrs. Cunningham.
Scotland	Jan. 15	John's Station	Mrs. McKimmon, Mrs. Cunningham.
Stanly	Aug. 12	Big Lick	Miss Hudgins, Miss Capps.
	Aug. 13	Endy S. H.	Miss Hudgins, Miss Capps.
	Aug. 14	Richfield	Miss Hudgins, Miss Capps.
Stokes	Aug. 13	Walnut Cove	Mrs. Hollowell, Wiss Ward.
	Aug. 14	Danbury	Mrs. Hollowell, Miss Ward.

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WOMEN'S INSTITUTES, 1913.

County	Date	Location	Lecturers
Surry	Aug. 2	Copeland	Mrs. Hollowell, Miss Phelps.
	Aug. 4	Pilot Mountain	Mrs. Hollowell, Miss Phelps.
	Aug. 5	Westfield	Mrs. Hollowell, Miss Phelps.
	Aug. 6	Antioch Church	Mrs. Hollowell, Miss Ward.
	Sept. 29	Piney Grove	Miss Webb, Mrs. Slagle.
Swain	July 26	Bryson City	Miss Parker, Miss Mahler.
Transylvania	Aug. 6	Selica	Miss Mahler, Mrs. Whitted.
Tyrrell	Dec. 18	Columbia	Mrs. McKimmon, Mrs. Cunningham.
Union	July 26	Wingate	Mrs. Hutt, Miss White.
	July 28	Waxhaw	Mrs. Hutt, Miss White.
	July 29	Prospect	Mrs. Hutt, Miss White.
	July 30	Indian Trail	Mrs. Hutt, Miss White.
Vance	Feb. 11	Middleburg	Mrs. Hollowell, Miss Mahler.
	Feb. 12	Bear Pond	Mrs. Hollowell, Miss Mahler.
	Sept. 9	Henderson	Miss Ward.
Wake	Feb. 19	Zebulon	Mrs. Hutt, Miss Ward.
Warren	Feb. 10	Warrenton	Mrs. Hollowell, Miss Mahler.
Washington	Dec. 10	Plymouth	Mrs. McKimmon, Mrs. Cunningham.
	Dec. 17	Mackey's Ferry	Mrs. McKimmon, Mrs. Cunningham.
	Dec. 19	Creswell	Mrs. McKimmon, Mrs. Cunningham.
Watauga	Sept. 19	Valle Crucis	Miss Webb, Mrs. Slagle.
	Sept. 20	Boone	Miss Webb, Mrs. Slagle.
Wayne	Jan. 15	Hood Swamp	Mrs. Hutt, Miss Ward.
	Jan. 16	Salem Church	Mrs. Hutt, Miss Ward.
	Jan. 17	Falling Creek	Mrs. Hutt, Miss Ward.
	Jan. 18	Smith's Chapel	Mrs. Hutt, Miss Ward.
	Jan. 23	Seven Springs	Mrs. Hutt, Miss Ward.
Wilkes	July 28	Beaver Creek	Mrs. Hollowell, Miss Phelps.
	July 29	Wilkerboro	Mrs. Hollowell, Miss Phelps.
	July 30	Ronda	Mrs. Hollowell, Miss Phelps.
	Sept. 27	Trap Hill	Miss Webb, Mrs. Slagle
Wilson	Feb. 15	Stantonsburg	Mrs. Hutt, Miss Ward.
	Feb. 17	Lucama	Mrs. Hutt, Miss Ward.
Yadkin	July 31	Yadkinville	Mrs. Hollowell, Miss Phelps.
	Aug. 1	Booneville	Mrs. Hollowell, Miss Phelps.
Yancey	Aug. 8	Burnsville	Mrs. Hutt, Miss Clement.
	Aug. 9	Bald Creek	Mrs. Hutt, Miss Clement.

LECTURERS AND SUBJECTS.

Name	No. Institutes Attended	Subjects
CAPPS, MISS ELIZABETH	16	Bread Making. Lunches. Household Conveniences.
CARPENTER, MISS NORA	15	Bread Making. Pin Money on the Farm.
CLEMENT, MISS LINDA	17	School Lunches. Bread Making.
CUNNINGHAM, MRS. J. S.	40	Bread Making. Household Conveniences

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LECTURERS AND SUBJECTS.

Name	No. Institutes Attended	Subjects
HENLEY, Mrs. J. M.	3	Bread Making. Household Conveniences. The Home Garden.
HOLLOWELL, Mrs. W. R.	55	Care of Infants. Value of Foods. Bread Making. The Country Woman and Her Relation to Home and Community.
HUDGINS, Miss CARRIE	32	The Country Home. Child Training. Canning. Home Nursing.
HUTT, Mrs. W. N.	64	Influence of Foods. Care of Infants. What to Do till the Doctor Comes.
MAHLER, Miss LOUISE	66	Kitchen Conveniences. Biscuit Demonstration. Bread Making.
MCKIMMON, Mrs. JANE	42	Breads and Bread Making. Health Talks.
PARKER, Miss KATHARINE	15	Breads and Bread Making. Health Hints.
PHELPS, Miss CAROLINE B.	16	Household Conveniences. Care of the Sick.
SLAGLE, Mrs. HENRY	13	Home Conveniences. Country Women's Organisations.
WARD, Miss JANE E.	43	Home Care of the Sick. Bread Making.
WEBB, Miss LUCIE	13	Fireless Cooker. Bread Making.
WHITE, Miss JESSIE	17	Care of the Sick. Fireless Cooker. Bread Making.
WHITTED, Mrs. J. M.	26	Poultry Raising. Care of Infants. Bread Making.

County and Local Women's Organizations.

The plan of organization of the Women's Institutes is the same as for men. An active, interested woman is selected for chairman and she is given the best committee that can be selected to assist her. The chairman and other members of the committee are expected to work up interest in Women's institutes and endeavor to get the coöperation of all the progressive farm women of the community in securing attendance at the institutes. They are also expected to have committee meetings during the year to discuss among themselves questions pertaining to their work. They should invite the women of the community to join them at these committee meetings and take part in the discussions.

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LIST OF CHAIRMEN OF WOMEN'S INSTITUTE COMMITTEES.

County	Chairman of Committee	Postoffice
Alamance:		
Oakdale	Mrs. J. A. Hornaday	Liberty.
Maywood	Miss Mary McCulloch	Burlington.
Hawfields	Mrs. R. W. Scott	Haw River.
Alexander	Mrs. W. J. Reece	Liledoun.
Alleghany	Mrs. T. J. Carson	Sparta.
Scottsville	Mrs. E. K. Plummer	Scottsville.
Anson	Mrs. J. G. Boylin	Wadesboro.
Peachland	Mrs. M. L. Horne	Peachland.
Ashe	Mrs. C. H. Smithdeal	Jefferson.
Grassy Creek	Mrs. Ed. Greer	Grassy Creek.
Bertie	Miss Clara Pigg	Coleraine.
Windsor	Mrs. W. E. Copeland	Windsor.
Bladen	Mrs. W. F. McNeill	Dublin.
Brunswick	Mrs. Q. K. Mints	Mill Branch.
Cool Run	Mrs. T. Mints	Shallotte.
Supply	Mrs. C. W. Kirby	Supply.
Winnabow	Mrs. Jack Johnson	Winnabow.
Buncombe:		
Democrat	Miss Bert Roberts	Democrat.
Swannanoa Test Farm	Mrs. R. W. Collett	Swannanoa.
Cabarrus	Mrs. D. B. Parrish	Concord.
Harrisburg	Mrs. W. D. Harris	Harrisburg.
Caldwell:		
Granite Falls	Mrs. J. M. Yount	Granite Falls.
Oak Hill	Miss Littie Deal	Lenoir.
Camden	Mrs. H. C. Ferebee	Camden.
Caswell	Miss Margaret Page	Yanceyville.
Leasburg	Miss Mattie Pullian	Leasburg.
Carteret	Mrs. H. I. Pridgen	Newport.
Catawba:		
Terrell	Mrs. T. F. Connor	Terrell.
Conover	Mrs. J. A. Yount	Conover.
Claremont	Mrs. H. S. Arndt	Claremont.
Wesley's Chapel	Mrs. Gordon Wilfong	Newton.
Fairview S. H.	Mrs. John Smith	Hickory.
Chatham	Miss Bonnie Cole	Riggsbee.
Farrington	Mrs. J. R. Matthews	New Hill.
Goldston	Miss Mollie Goldston	Goldston.
Siler City	Mrs. D. L. Webster	Siler City.
Cherokee	Mrs. Geo. Walker	Andrews.
Murphy	Mrs. J. T. Hayes	Tomotla.
Clay	Mrs. Claud Sanderson	Hayesville.
Ogden	Mrs. R. L. Johnston	Brasstown.
Elf	Miss Mary Ray	Hayesville.
Cleveland	Mrs. Elam	Cleveland Mills.
Columbus	Mrs. J. A. Formyduval	Old Dock.
Craven	Mrs. B. P. Whitford	Askin.
Cumberland	Mrs. M. Maxwell	Fayetteville.
Stedman	Mrs. Bessie Butler	Stedman.
Currituck	Mrs. H. E. Morrisette	Currituck.
Jarvisburg	Mrs. H. D. Newbern	Powells Point.
Davidson:		
Clarksbury	Mrs. Carrie Clodfelter	Lexington.
Cedar Springs	Mrs. J. R. Crouse	Cid.
Enterprise	Mrs. M. E. Mock	Enterprise.
Wallburg	Mrs. C. M. Wall	Wallburg.
Tyro	Mrs. Mary Wilson	Linwood.
Kennedy School House	Mrs. B. E. Paine	Thomasville.

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LIST OF CHAIRMEN OF WOMEN'S INSTITUTES.

County	Chairman of Committee	Postoffice
Davie:		
Center Church	Mrs. W. H. Griffin	Mocksville.
Fork Church	Mrs. Jos. Brimgar	Mocksville
Duplin	Mrs. I. L. Faison	Faison.
Durham	Mrs. Ike Suits	Durham.
Edgecombe	Mrs. B. F. Shelton	Speed.
Whitakers	Mrs. L. L. Draughon	Whitakers.
Forsyth:		
Clemmons	Mrs. T. W. Griffith	Clemmons.
Burke's Grove	Mrs. H. W. Johnson	Winston-Salem.
Franklin	Mrs. J. B. Fulghum	Louisburg.
Gaston:		
Sunnyside S. H.	Mrs. J. T. Oates	Bessemer City.
Chapel Church	Mrs. Peter Rhyne	Gastonia.
Gates	Mrs. R. W. Simpson	Trotville.
Guilford:		
Colfax	Mrs. Henry Cude	Colfax.
Pleasant Garden	Mrs. S. L. Foust	Pleasant Garden.
Halifax	Mrs. G. W. Bryan	Scotland Neck.
Littleton	Mrs. J. W. Rhodes	Littleton.
Haywood:		
Bethel	Mrs. J. E. Wilson	Canton.
Rock Hill	Mrs. Jas. Boyd	Waynesville.
Henderson:		
Green River S. H.	Mrs. P. J. Hart	Zirconia.
Mills River	Mrs. Tom Osborne	Horse Shoe.
Liberty S. H.	Miss Willie Brown	Hendersonville.
Hertford	Mrs. S. B. Taylor	Winton.
Murfreesboro	Mrs. J. D. Bruner	Murfreesboro.
Hoke	Mrs. T. B. Upchurch	Raeford.
Hyde	Mrs. S. D. Mann	Swan Quarter.
Fairfield	Mrs. J. C. Watson	Fairfield.
Iredell	Mrs. W. L. Cook	Mooresville.
Cool Springs	Miss Mabel Swann	Elmwood.
Eupeptic Springs	Mrs. R. L. Alexander	Harmony.
Jackson	Mrs. A. C. Reynolds	Cullowhee.
Quallatown	Mrs. P. H. Ferguson	Whittier.
Johnston	Mrs. J. L. Boyette	Kenly.
Jones	Mrs. Geo. White	Pollocksville.
Trenton	Miss Bessie Whitaker	Trenton.
Lee	Miss Mamie Carter	Glendon.
Lenoir	Mrs. Mary D. Pitte	LaGrange.
Lincoln:		
Iron Station	Mrs. S. N. Brown	Iron Station.
Reepsville	Mrs. L. S. Kiser	Reepsville.
McDowell	Mrs. J. E. Jimeson	Garden City.
Old Fort	Mrs. Chas. Burgin	Old Fort.
Macon:		
Higdonville	Mrs. S. E. Gray	Higdonville.
Maxwell's S. H.	Mrs. Henry Slagle	Franklin.
Otto	Mrs. D. P. Cabe	Otto.
Madison:		
Mars Hill	Mrs. R. L. Runion	Mars Hill.
Marshall	Miss Ollie Hendricks	Marshall.
Martin	Mrs. W. T. Taylor	Robersonville.
Oak City	Mrs. Justus Everett	Palmyra.

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LIST OF CHAIRMEN OF WOMEN'S INSTITUTES.

County	Chairman of Committee	Postoffice
Mecklenburg:		
Huntersville	Mrs. Hattie Bradford	Huntersville.
Paw Creek	Mrs. Felix Beatty	Paw Creek.
Dixie	Mrs. Ferrie Pegram	Charlotte.
Mitchell	Mrs. M. J. Bowditch	Toecane.
Montgomery:		
Star	Mrs. Jonah Leech	Star.
Mt. Gilead	Mrs. J. P. Haywood	Mt. Gilead.
Moore:		
West End	Miss Mary Von Canon	West End.
Carthage	Mrs. Spence Kelley	Carthage.
Hemp	Mrs. N. J. Carter	Hemp.
Cameron	Mrs. M. McL. McKeithan	Cameron.
Aberdeen	Mrs. Henry Page	Aberdeen.
Nash	Mrs. J. T. Strickland	Nashville.
Stanhope H. S.	Mrs. W. A. Harper	Spring Hope.
New Hanover	Mrs. E. I. Herring	Wilmington.
Northampton	Mrs. J. W. Jessup	Rich Square.
Lasker	Mrs. T. G. Whims	Lasker.
Seaboard	Mrs. M. R. Stevenson	Seaboard.
Onslow	Mrs. C. B. Basden	Richlands.
Harris S. H.	Mrs. H. B. Williams	Jacksonville.
Orange	Mrs. Carl Forest	Efland.
Pasquotank	Mrs. R. N. Morgan	Elisabeth City.
Salem	Mrs. S. J. Parsons	Weeksville.
Pender	Mrs. E. McW. Moore	Burgaw.
Person	Mrs. C. M. Winstead	Roxboro.
Pitt	Mrs. J. R. Quinerly	Grifton.
Polk	Mrs. L. H. Cloud	Columbus.
Randolph:		
Liberty	Miss Ida Williams	Liberty.
Farmer	Mrs. Frances Hubbard	Farmer.
Mt. Olivet	Mrs. J. E. Sugg	Erect.
Parks Cross Roads	Mrs. J. A. Ellis	Ramseur.
Sophia	Mrs. L. B. Cole	Sophia.
Richmond	Mrs. Hattie Ellerbe	Rockingham.
Hoffman	Mrs. N. C. Scarboro	Hoffman.
Robeson	Mrs. D. Y. McGoogan	Lumber Bridge.
Hallsboro	Mrs. Lucy Brown	Hallsboro.
Fairmont	Mrs. D. W. Galloway	Fairmont.
Rockingham	Mrs. C. J. Wariner	Ruffin.
Rowan:		
Mt. Ulla	Miss Nannie Hart	Mooresville.
China Grove	Mrs. H. E. Endy	China Grove.
Liberty S. H.	Miss Daisy Morgan	Gold Hill.
Rockwell	Mrs. W. J. Cline	Gold Hill.
Woodleaf	Mrs. C. H. Gillian	Woodleaf.
Rutherford	Mrs. L. E. Rollins	Rutherfordton.
Ellenboro	Miss Ida Green	Ellenboro.
Sampson	Mrs. S. H. Hobbs	Clinton.
Garland	Mrs. W. B. Lamb	Ingold.
Salemburg	Mrs. W. J. Jones	Salemburg.
Newton Grove	Miss Bessie Cox	Newton Grove.
Scotland	Mrs. J. T. John	John Station.
Stanly	Miss Irma Richie	Richfield.
Big Lick	Miss Eva Whitley	Mt. Pleasant.
Endy S. H.	Miss Letha Treece	Big Lick.

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LIST OF CHAIRMEN OF WOMEN'S INSTITUTES.

County	Chairman of Committee	Postoffice
Surry:		
Copeland	Mrs. J. W. Hancock	Rockford.
Pilot Mountain	Mrs. R. E. Flippen	Pilot Mountian.
Westfield	Miss Effie A. Hill	Mt. Airy.
Antioch Church	Mrs. J. W. Johnson	Mt. Airy.
Piney Grove	Mrs. J. L. Jackson	Mt. Airy.
Swain	Mrs. F. H. Smiley	Bryson City.
Transylvania	Mrs. C. C. Duckworth	Brevard.
Union:		
Wingate	Mrs. J. R. Brown	Wingate.
Waxhaw	Miss Tillman	Waxhaw.
Prospect	Mrs. M. S. Yarborough	Monroe.
Indian Trail	Mrs. H. W. Abernathy	Matthews.
Vance	Miss Mary Burwell	Kittrell.
Wake	Mrs. John Broughton	Zebulon.
Warren	Mrs. F. P. Bowden	Manson.
Washington	Mrs. T. A. Brooks	Bath.
Aurora	Mrs. B. T. Bonner	Aurora.
Watauga	Mrs. W. E. Shipley	Valle Crucis.
Boone	Mrs. R. M. Green	Boone.
Wayne	Mrs. M. A. Howell	Goldsboro.
Falling Creek	Mrs. E. A. Stevens	Goldsboro.
Smith's Chapel	Mrs. Joe Parker	Mt. Olive.
Wilkes	Mrs. Thos. Andrews	Wilkesboro.
Beaver Creek	Mrs. Chas. Hartley	Kendall.
Ronda	Mrs. J. I. Dimmette	Dimmette.
Traphill	Mrs. Nancy Spicer	Traphill.
Wilson	Mrs. W. J. Sloan	Stantonsburg.
Yadkin	Mrs. W. H. Hall	Yadkinville.
Booneville	Mrs. A. S. Speer	Booneville.
Yancey	Mrs. W. J. Waycaster	Bald Creek.

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PROGRAM FOR NORMAL INSTITUTE

July 15, 16 and 17, 1913

TUESDAY MORNING.

9:30. Called to order by Director T. B. Parker.

MEN'S MEETING.

9:30. A Short Description of the Soil Types of the State—J. L. Burgess, M. E. Sherwin.

10:15. How Deep Should Land be Broken for Corn and Cotton—C. R. Hudson, C. L. Newman. Discussion.

11:00. How Early Should Corn and Cotton be Planted?—C. B. Williams, T. B. Parker. Discussion.

11:45. What is the Best Distance to Sow Rows of Corn and What is the Best Spacing in Rows?—G. M. Garren. Discussion.

12:30. What is the Best Distance to Have Rows of Cotton and What is the Best Spacing in Rows?—T. D. McLean. Discussion.

Adjourn until 2:00 p. m.

TUESDAY AFTERNOON.

2:00. How Deep Should Corn and Cotton be Cultivated?—T. E. Browne. Discussion.

2:45. How Often and How Long Should Corn and Cotton be Cultivated?—J. L. Burgess. Discussion.

3:30. What Should be the Method of Cultivation of Corn and Cotton after a Wet Spell? Round Table. Discussion.

4:00. Does it Pay to Make the Second and Third Application of Fertilizer to Corn and Cotton? If so, When?—B. W. Kilgore. Discussion.

4:45. What is the Most Economical Method of Harvesting Corn?—C. L. Newman. Discussion.

5:15. When and How Should Stable Manure be Applied?—Round Table.

WEDNESDAY MORNING, JULY 16.

9:00. When Should Land be Broken for Wheat and Other Small Grains?—M. J. Hendricks. Discussion.

9:30. What are the Best Varieties of Small Grain for this State and Where should we Obtain Them?—J. L. Burgess. Discussion.

10:00. When and How to Sow Crimson Clover, Vetch and Rye in Growing Crops for Winter Cover Crops—T. D. McLean. Discussion.

10:45. At What Stage in Growth Should These Crops be Plowed Under for Best Results? And Does Plowing Under Green Crops in Hot Weather Sour Land?—J. L. Burgess, C. B. Williams. Discussion.

11:30. How Cheaply can Pork be Grown and What Crops Should be Planted for Economical Pork Production?—D. T. Gray. Discussion.

12:15. When Should Grasses be Cut for Dairy Cattle and When for Work Stock to Obtain Best Feeding Value?—R. S. Curtis. Discussion.

WEDNESDAY AFTERNOON, JULY 16.

2:00. What is the Best Method of Saving Peavine and Soy Bean Hay? Round Table. Discussion.

2:30. Is Silage a Safe and Economical Feed for Horses and How Many Horses will Justify a Silo?—J. C. McNutt. Discussion.

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3:00. The Sweet Potato: How to Grow and Harvest. Round Table.
3:30. Poultry on the Farm. What Breeds?—E. L. Green. Discussion.
4:00. Construction of a Mangum Terrace and When Advisable—C. L. Newman.
4:30. Fruit on the Farm. A Good Selection—J. C. Pillsbury.
5:00. The Kitchen Vegetable Garden—Detjen.

THURSDAY MORNING, JULY 17.

9:00. Farm Management—J. M. Johnson.
10:00. Coöperation: Different Forms and When Advisable—C. H. Poe, J. L. Rives. Discussion.
10:45. Dairying and Dairy Cattle—A. J. Reed, John Robinson.
11:30. The Silo and Its Use—W. H. Eaton.
12:00. General Instruction to Lecturers—T. B. Parker.

WOMEN'S NORMAL INSTITUTE.

JULY 15, 16, 17, 1913.

PROGRAM—9:30 A. M.

The Qualifications of a Successful Institute Worker—Mrs. Henrietta W. Calvin.
The Country Woman and Her Relation to the Home and the Community—Mrs. W. R. Hollowell.
The Needs of the Country Woman—Round Table Discussion.
Lessons in Bread Making—Mrs. Chas. McKimmon.
Household Conveniences—Miss Caroline Phelps.
Demonstration, the Fireless Cooker—Mrs. H. W. Calvin.
Time-Saving Appliances—Miss Jessie White.
Demonstration, Biscuit Making—Miss Louise Mahler.
Economies in Cooking—Mrs. J. M. Whitted.
Demonstrtaion, Coffee Making—Miss Phelps.
Training Farmers' Daughters to be Farmers' Wives—Mrs. R. W. Orr.
The Relation of Parents to the Public Schools—Miss Linda Clement.
The Care and Training of Children—Miss Carrie Hudgins.
The Care of Infants—Mrs. W. R. Hollowell.
The Moral Training of Our Children—Mrs. R. W. Orr.
Physical and Moral Training of Children—Miss Linda Clements.
Rural Life as We Should Make it—Miss Jessie White.
Training the Child of Today for the Man or Woman of Tomorrow—Mrs. R. W. Orr.
Home Sanitation—Miss Katharine Parker.
Health on the Farm—Miss Linda Clement.
Subject to be Supplied—Miss Carpenter.
Subject to be Supplied—Miss Capps.
Judging Bread—Mrs. Calvin.
Judging School Lunches—Mrs. Calvin.
Women's Farm Life Convention—Mrs. Charles McKimmon, Chairman, Raleigh.

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PROGRAM

OF THE

ELEVENTH ANNUAL

STATE FARMERS' CONVENTION

AND

ROUND-UP INSTITUTE

PULLEN HALL

A. & M. College, West Raleigh, N. C.

August 26, 27 and 28

1913

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OFFICERS.

PRESIDENT—S. H. HOBBS, Clinton.
SECRETARY—T. E. BROWNE, West Raleigh.

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PROGRAM.

TUESDAY, AUGUST 26.—SOIL DAY.

10:30 A. M.—Greetings—President D. H. Hill and Commissioner W. A. Graham.
Soil Work in the State—By Director B. W. Kilgore, Raleigh, N. C.
Do Soils Wear Out?—Prof. C. L. Newman, A. & M. College.
How I am Saving Labor by Tillage Implements—W. D. Boseman, Rocky Mount, N. C.
Results of Late Applications of Commercial Fertilizers—By C. B. Williams, North Carolina Experiment Station.
Dinner.
2 P. M.—Address—C. W. Spruill, President of the Convention.
2:30 P. M.—Demonstration of Constructing the Mangum Terrace—By P. H. Mangum, Wake Forest, N. C.
3 P. M.—Demonstration in Laying Out, Digging and Placing of Farm Tile—H. M. Lynde, U. S. Department of Agriculture, and Prof. M. E. Sherwin, A. & M. College.
7:30 P. M.—Essential Principles of Coöperation—Dean H. C. Price, State University, Columbus, Ohio.
Marketing Cotton—By C. J. Brand, U. S. Department of Agriculture.
Coöperation in Marketing Fruit Crops—By J. F. Fooshe, *Progressive Farmer*, Raleigh, N. C.
Coöperation in Live Stock and in Dairy Products—By A. O. Nelson, Svea, Minn.

WEDNESDAY, AUGUST 27.—LIVE STOCK DAY.

5 A. M.—Trip over College and Station Farms.
7:45 A. M.—Judging Farm Mules—By Prof. J. C. McNutt, A. & M. College.
8:15 A. M.—Judging Draft Horses—By Schuyler Salisbury, A. & M. College.
8:45 A. M.—Judging Hogs—By Dan T. Gray, N. C. Experiment Station.
9:30 A. M.—Silage for Beef Cattle—By W. F. Ward, U. S. Department of Agriculture.
10:15 A. M.—Development of a Profitable Dairy Herd—By Alvin J. Reed, U. S. Department of Agriculture.
11 A. M.—Southern Markets for Beef Cattle and Sheep—By R. S. Curtis, N. C. Experiment Station.
11:45 A. M.—Demonstration of Methods of Injecting Hog Cholera Serum—By Dr. B. B. Flowe, State Department of Agriculture.
12:30 P. M.—Demonstration in the Recognition of Tuberculosis in Cattle—By Dr. G. A. Roberts, A. & M. College.
Dinner.
2 P. M.—Public Sale of Berkshires, Poland Chinas and Duroc-Jerseys, held under the management of the North Carolina Swine Breeders' Association.
7:30 P. M.—A Message from the Sand Hills—By Hon. Henry A. Page, Aberdeen, N. C.
8:30 P. M.—Address—By Hon. A. F. Lever, Chairman Committee on Agriculture, House of Representatives, Washington, D. C.

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THURSDAY, AUGUST 28.

7:30 A. M.—Practical Demonstration of the Principal Stages in the Production of Peaches and Apples:

1. Methods of "Laying Off" the Orchard.....MR. DETJEN
2. Planting the Tree, and Its First Pruning....MR. STODDARD
3. Training the Tree.....PROF. PILLSBURY
4. Methods of Cultivation and Implements.....PROF. HUTT
5. "Worming" the Trees.....MR. SHUFORD
6. Preparation of Bordeaux Mixture.....PROF. FULTON
7. Preparation of Lime-Sulphur Solutions....PROF. SHERMAN
8. Spraying the Trees.....MESSRS. HILL AND KLEIN
9. Picking and Packing the Fruit.....MR. SHAW

9:30 A. M.—This Farm Pays: That One Does Not. Why?—By J. M. Johnson, U. S. Department of Agriculture.

10:15 A. M.—How to Prevent Cottonseed Meal from Poisoning Hogs—By Prof. W. A. Withers, A. & M. College.

11 A. M.—Business Meeting.
Election of Officers.
Reports of Committees.

PROGRAM HOUSEWIVES' CONVENTION.

At Raleigh High School Building.

MRS. CHARLES MCKIMMON, *Chairman.*
MISS JANE WARD, *Secretary.*

The Housewives' Convention is designed to bring housekeepers together for discussion of better methods of living; how best to make the household expenditures, how to market, to cook, to sew, to care for children, and to improve home conditions generally.

Every woman in North Carolina is invited to come, and Dr. Hill, President of the A. and M. College, offers the College Dormitories free to any one wishing to come.

If this offer is to be taken advantage of, sheets, towels and pillow cases should be brought. Meals may be secured at the College at twenty-five cents each.

TUESDAY, AUGUST 26.—10 A. M. TO 2 P. M.

Address of Welcome.....MAJ. W. A. GRAHAM
(Commissioner of Agriculture.)
The Object of the Convention.....MRS. MCKIMMON, *Chairman*
The Power of the Organized Housewife.....MRS. JULIAN HEATH
(Of N. Y., Founder Housewives League of America.)
Talk on Appetizing Ways of Cooking Meats, with a Demonstration—
MISS EMILY G. BOSSONG (of New York)
Talk on Kitchen and Household Conveniences.
Demonstration Fireless Cooker.
Discussion.

WEDNESDAY, AUGUST 27.—10 A. M. TO 2 P. M.

Talk .....T. B. PARKER
(Director Farmers Institutes.)
Lesson in Bread Making. Anyone invited to join. Please bring Apron and Dish Towel.....MRS. MCKIMMON
Talk on Batter Breads, with Demonstration in Making Queen of Muffins .....MISS BOSSONG
The Forgotten Market Basket.....MRS. JULIAN HEATH
How I Made My Crop.....TOMATO CLUB GIRL
Demonstration of Canning in Tin for the Market—
ALAMANCE COUNTY TEAM OF TOMATO CLUB GIRLS
Talk on Soups, with Demonstration.....MISS BOSSONG

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THURSDAY, AUGUST 28.—10 A. M. TO 2 P. M.

Lessons in Bread Making.....MRS. MCKIMMON
Talk .....D. H. HILL
(President A. & M. College.)
Talk on Salads, with Demonstration.....MISS BOSSONG
Coöperation of Women from Town and Country.....MRS. HEATH
The Care of the Child.....RALEIGH PHYSICIAN
Fireless Cooker Demonstration.
Discussion.

Some Things I Have Found Helpful in My Own Home.

MRS. HENRY SLAGLE.

As the demands of life are much the same with all of us, necessarily our needs are much the same. I have been a home-keeper for more than twenty-five years and have made it a close study, trying to find the best and easiest way of doing things, and I have much to learn yet. I am always glad to get any new ideas or suggestions from my coworkers, so I will tell first of the arrangement of my kitchen. As I got some of my best ideas from some of our institute workers, I would like to pass them on; someone else might be as glad to get them as I was.

My kitchen is small, 12 by 15 feet. I like to get things as near together as possible. On the west side I have a door with water running right to it. Just outside I have a sink to carry off the waste water. There are two large windows right together which give plenty of light for my range that sits right under them. It is a Queen Kalamazoo range and it cost only $36.67 delivered at Franklin. A cousin bought a range very much like mine from an agent, and she gave $75 for hers. We farmer folks do give lots of our money to traveling agents. In this case she gave a little more than twice as much for her stove, and it was not any better than mine. Above the two windows I have an air-shaft as near the overhead ceiling as possible, 25 inches long and 6 inches wide, for an escape for hot air and smoke and fumes. I like it very much, for so often something boils over or something drops on the stove when it is hot and the whole house is filled with smoke; but this opening carries it all off. In the heat of summer the air never gets stuffy. I made a shutter to close in very cold weather, with hinges put on so the door will drop down; then I can close it with a broom handle or a stick of stove wood. I put a piece of wire screen on the outside to keep flies out. Behind my range I have a space three feet between it and the dining room, and on this wall I have a drop shelf fastened to the wall with strap hinges and a strong brace in the middle fastened to the shelf with another strap hinge. The shelf just drops down against the wall and is entirely out of the way until I want to use it, when I lift it up and set the brace on a little block of wood which has been nailed on the wall to support it. This I find very convenient for raising lightbread and for many other purposes. The dining-room door has swinging hinges, so in going to and from the dining-room with both hands full all I have to do is to walk against the door and it will swing open either way.

I also have a large deep cupboard built in the corner right behind where this door opens and just opposite my range. In making one of these get a good workman and then it will always be satisfactory. It is not always the things we get for the least money that prove to be most economical. I got a good carpenter and he made the frame or face of this cupboard of oak that would take a nice finish. He put in a set of slides 3 feet and 3 inches above the floor for two nice deep drawers. One of these I use for all my kitchen trinkets, such as spoons, egg-beaters, broilers, etc., and the other for a meat drawer. I can put a whole ham in it and my meat for seasoning. Nice brass rings for the drawers cost 20 cents. Below the drawers are two doors opening into the lower part where I keep all my pots, pans, muffin rings, etc., and

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above are two much longer doors, opening into a number of shelves, where I keep various things, dishes for taking up meals, tea, coffee, spices, starch, soap, and a great many other things, so that I don't have anything hanging on the walls except dish pans; everything is away from dust and flies. Just to the left of this and right up against it is a rather large table on castors that I can move into the middle of the room or before the door to work when it is hot. This table also contains a large drawer for kitchen towels. There is also the meal chest, containing three apartments, each having a separate lid. It stands just 31 inches high. I had it made to suit my height for kneading bread. The chest itself is 15 inches above the floor, the end pieces being cut out of broad plank and shaped to serve as legs.

Then the fireless cooker, last but by no means the least, is a *luxury*. After using one we don't want to do without it; it is so helpful, convenient, and such a comfort. When you want to go to church or anywhere in the morning, just put your dinner in the cooker and there is no danger of its burning, no fires to keep up, and when you get home you have a hot dinner ready to serve. I don't think there is any other way of cooking meats to make them so good. Your roast beef, mutton chops, broiled chicken or anything else is better cooked in the fireless cooker than in any other way.

A sink in the kitchen saves so many steps even if there is no running water in the house; it will save time and opening doors when it is cold. There are many other little conveniences and ways of making work easier that every woman might have if she would study her situation and make the most of her opportunities. She should be an equal partner with her husband in sharing things, good or bad, and if they are able to have improvements on the farm they ought to have them in the house too.

Another important thing my long experience as a mother and housekeeper has taught me is the need of being ready for any emergency. Keep all kinds of medicines and remedies on hand and learn how to use them. We can train ourselves to be dependent or independent as we will. I have raised eight children and Providence has been kind, but if I should tell you how few calls we have had for a doctor you would not believe that I am as great a friend to them as I am. We have called a physician to visit our children in only three cases. We have never lost one, and they are all strong and well now. Of course they have had many little accidents. The worst was with our second son. He was working in the blacksmith shop and had a piece of red-hot iron in the tongs, and when he struck it with the hammer it flew out of the tongs and struck him on the eye, cutting through the lid, and made a slight cut on the ball one-half inch long, not quite reaching the sight. He came to the house with his dirty hand over it and said, "Mother, I have ruined my eye." I looked at it and it did look like it might be ruined sure enough, with the blood running down on his cheek through the smut and dirt off of his hand. But I ran to one of my emergency bottles and got a tablet of bichloride of mercury and put one quart of warm water on it in a basin. Then I got a large clean cloth and swabbed his eye and face off, and for fear I had not gotten it entirely clean I made another solution exactly like the first and went over it again. Next I got a bottle of borax water that I kept for burns and sore throats and wet a good big piece of absorbent cotton and put it on his eye and bound it up. Then I went to the telephone and called the doctor, and as he had just had a call above our home he said he would be along in a little while and bring me a dressing. When I told him what I had done for it, he said I did not need anything else, but I used the borated vaseline that he brought and in one week the eye was ready for the bandage to be taken off, and it never did inflame one particle. The time to save trouble is in the beginning. Always disinfect a hurt, even a small one, right at first. I like to keep a little bag of sterile cloths for binding up wounds, and this is the way I sterilize them. Put one bichloride tablet in one quart of water in a porcelain vessel and then put the cloths in it and boil them. Then dry in the sun and wrap them up carefully in another cloth and they are ready for use. When your little boy sticks a rusty nail in his

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foot, put some kind of a disinfectant as quickly as possible into a basin of water just as hot as the child can stand and have him keep it there fifteen minutes anyway. If you don't have bichloride of mercury or carbolic acid or some other good one, put one teaspoonful of copperas into the water; then take out of the water and dry off and drop turpentine into the place as long as it will absorb any and bind it up. It will never give you any trouble. Have your bottle of iodine to paint behind the baby's ear when he takes earache. A few drops of warm water and glycerine in the ear is good. One-half teaspoonful of borax to one glass of water used as a gargle in sore throat always relieves. Add to a five-cent bottle of vaseline one teaspoonful of powdered borax for a dressing for burns. One teaspoonful of boracic acid (this is the refined borax) added to one-half pint of water and brought to a boil (then cooled and bottled) is one of the best eye washes at all. It will relieve any burning or soreness of the eyes. This should always be used in an infant's eyes at birth and every morning until the child is a few weeks old. Many make a weak solution of this and swab out the mouth every morning to prevent thrush.

NOTE BY T. B. PARKER.—Bichloride of mercury is a valuable family medicine; it is also a deadly poison and should be treated as such by keeping it and all other poisons under lock and key where children can not get to them.

Every poison should be labeled as such and have its name in big letters so you may know just what it is, and kept entirely away from the ordinary household remedies, so as to prevent mistakes that may cause death.

Within the last year we have heard of several instances of bichloride of mercury being taken for headache tablets, through mistake, with fatal results. We can not be too careful about poisons. Great sorrow and affliction have come to many families on account of carelessness in this respect. Either lock them up or throw them away where they can do no harm. It will be well to have posted in a conspicuous place where poisons are kept a notice like this (written by Dr. Harvey W. Wiley) (which I have copied from the December number of *Good Housekeeping*):

FIRST AID IN POISONING.

Paste this in your medicine chest. Number your poison bottles to correspond to the numbers given here; then you can tell at a glance what antidote to give or take.

1. ARSENIC (Fowler's solution, Arsenic Trioxid, Cuprous Arsenite).	1. Give a tablespoonful of mustard and salt in a glass of warm water, or thirty grains of zinc sulphate, or evacuate the stomach with a pump. Afterward give one tablespoonful of ferric hydrate every fifteen minutes, or same quantity of dialyzed iron. Apply external heat and stimulants.
2. ACETANILID AND PHENACETIN (nearly all headache remedies).	2. Symptoms, cyanosis (blue lips), weak pulse, sweating. Lower head; apply heat to body; if stimulants are required, give whiskey, strychnin, or belladonna, and oxygen inhalations.
3. AMMONIA OR CAUSTIC POTASH OR SODA.	3. Give dilute acid (lemon juice in water or vinegar). Afterward plenty of milk and eggs or olive oil.

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4. BICHLORIDE OF MERCURY.	4. Give a tablespoonful of mustard and salt in a glass of warm water, or thirty grains of zinc sulphate. Afterwards milk and eggs. If in collapse, use heat and stimulants.
5. BELLADONNA OR ATROPIN.	5. Give a tablespoonful of mustard and salt in warm water. After vomiting, one-quarter grain of morphin sulphate. Stimulants if required.
6. CARBOLIC ACID (Phenol).	6. Flour and water; use stomach pump or give one ounce of Epsom salts, or two to four ounces of whiskey or slightly diluted alcohol. If in collapse, add heat to body.
7. CHLORAL AND CHLOROFORM.	7. External heat, keep head low, use stomach pump or give emetic of half an ounce of mustard and salt in warm water. Friction to body. Hot black coffee.
8. COCAINE.	8. Stimulants: Nitrate of Amyl, brandy or aromatic spirits of ammonia. Black coffee, external friction.
9 IODIN.	9. Starch made into drafts with cold water. Stomach pump or tablespoonful of mustard in a glass of water.
10. MORPHINE, SULPHATE, OPIUM, AND PAREGORIC.	10 Stomach pump or tablespoonful of mustard and salt or grease in warm water. Potassium permanganate, ten grains in glass of water. Black coffee. Keep patient awake. Supply heat. If stimulation is required, use atropin or strychnin.
11. MINERAL ACIDS.	11 Stomach pump, alkalies, as magnesium carbonate or baking soda, also milk, sweet oil or eggs. Heat or stimulants, if required.
12. PHOSPHOROUS.	12. Stomach pump, or three grains of copper sulphate in water every fifteen minutes until vomiting is induced, or thirty drops of oil of turpentine every quarter hour for four doses. Give purge. Avoid fats and oils.
13. STRYCHNINE.	13. Stomach pump or a tablespoonful of mustard and salt in warm water. Keep patient quiet. Seven to ten grains of tannic acid. For convulsions use chloral or chloroform. Inhale amyl nitrate.
14. ILLUMINATING GAS.	14. Remove patient to fresh air. Give oxygen to inhale. Use pulmotor or some form of artificial respiration. Supply warmth to extremities.

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Good Housekeeping ought to do as much as possible to put an end to these unfortunate fatalities. First of all, segregate all poisonous drugs in the household, as advised before. Second, study some simple remedies which may be applied in case of poisoning by the common poisons until medical attendance can be secured. To this end a page has been prepared of some common poisons, with a few of their simple antidotes. The readers of *Good Housekeeping* magazine are requested to cut this page out and paste it plainly in every closet or cupboard in which deadly drugs are kept. Not only should each reader do this, but the remedies and antidotes should be clearly kept in memory.

STOMACH PUMPS AND ANTIDOTES.

As a rule the first thing to do when a poisonous dose has been swallowed is to empty the stomach. A stomach pump does not cost very much, and its operation is extremely simple. Every family should be provided with one, or else make sure that one is easily accessible in the immediate neighborhood. A stomach pump is to be preferred to the ordinary emetics. It may not, however, always be possible to secure one. For this reason it is advised that a few household emetics be kept on hand.

A spoonful of powdered mustard to which a considerable quantity of common salt has been added, suspended in warm water, makes a very effectual and reasonably prompt emetic. In fact, emesis as a rule can be easily and promptly secured by drinking copious drafts of lukewarm water, almost saturated with salt. The mustard, however, renders the emesis still more prompt. This simple method of producing emesis is to be preferred to the use of sulphate of zinc or other mineral emetics. The mineral emetics are, however, very prompt and are easily kept on hand, zinc sulphate being the one usually recommended. Epecac can be easily kept and is also efficient. Thus it is seen that the first step in case of poisoning is to evacuate the stomach, preferably by mechanical means, otherwise by emetics which are easily kept in every household.

After this, the proper antidotes are to be administered. It would be a wise plan for the housekeeper to keep on hand some of these common antidotes. For instance, arsenic poisoning is very common, and the best antidote for arsenic poisoning is hydrate of iron, that is, an iron salt precipitated with ammonia. The efficiency of this remedy, however, largely depends upon its freshness. It therefore can not be kept ready, and in lieu thereof the housekeeper should have the simple ingredients for making it. Two bottles, one holding a solution of ferric sulphate and the other magnesium oxid, suspended in water, are easily kept, and can be prepared by the druggist of such strength that, when mixed, the ferric hydrate is completely precipitated. When these two solutions are mixed together and thoroughly shaken, they are ready at once for administration in arsenic poisoning, and if promptly used would save many lives. This mixture of iron hydrate should be given in large doses and frequently repeated.

Vinegar, which is a splendid antidote for caustic potash and ammonia, is always available. The best stimulants, as a rule, are whiskey, and, in some cases, caffein or hot coffee. It is not advisable to keep on hand such stimulants as strychnin or chloral or chloroform, which are themselves poisons. They can, however, be promptly secured at any neighboring drug store, though perhaps no more quickly than a physician could be called.

THE NEED FOR CARE.

Families are, of course, not expected to keep in stock apparatus for the inhaling of oxygen, or to be possessors of a pulmotor. It is the part of wisdom, however, for every one to know where such an apparatus can be obtained for these purposes, so that in case of asphyxiation or other paralysis of the nerves and muscles which control respiration artificial breathing can be set up. This is particularly true in those numerous cases of poisonings due to the inhalation of illuminating gas.

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Let every household into which *Good Housekeeping* goes have all of these poisons segregated and properly marked. Have the list of poisons and their simple antidotes pasted in plain view, and know where an oxygen inhaler and pulmotor can be secured promptly in case of emergency. By these wise precautions many lives may be saved.

The Country Home.

MISS CARRIE HUDGINS.

The word home carries with it music and melody if it is a home in the finer sense. Houses on every hand are waiting to be made into homes, and it is the woman in the home who makes it what it is; so let us be up and doing.

A casual glance at the home and refinement and cleanliness should be our first and lasting impression. No work requires more system and order than the home, to accomplish the desired end; many steps are wasted because no specific plans are made. Eliminate from the home the useless bric-a-brac of years ago. They are no good and mean lots of work if they are kept clean, for they are great dust-catchers.

Floors are one of the greatest problems of housekeeping and rightly so, if there is a large family to look after and scouring to be done once or twice a week. Stained floors with a top dressing of floor oil seems to be the cheapest and most satisfactory floor dressing. A floor oiled once or twice a year will protect the stain and keep down the dust.

How the whole family dread spring cleaning. Let's try to do this work in a more systematic way; not have the whole house torn up for a week, and everything out of its place. A better plan is to clean one room at the time, and put it in order before attempting another. Carpets should be taken up, well cleaned and aired before replacing.

In buying furniture care should be taken, for the appearance of the room and the amount of labor required to keep it in order depend much on the selection. Plain furniture is much prettier and more easily kept than the many scrolled designs. The parlor in many homes is the most uncomfortable room in it; especially so if it is one of the closed up kind, where fresh air and sunshine are rarely permitted. Don't be afraid of sunshine and air even if they do fade the carpet and wall paper. It is one of God's greatest blessings to us; so let it in.

Look out for an air of comfort for the living room; here is where the family come together for rest and recreation, and if it is not found here it will be sought at other places. The children obtain their lasting impressions of the home and begin to lay plans for another home perhaps in the far future.

The yard requires taste and skill as much so as the inner furnishings of the house. Every yard can't have a beautiful lawn laid off symmetrically with the shrubbery clumped here and there; however, every one can be clean with no rubbish around; flowers may adorn it with little or no expense.

In the country home is found the opportunity for children to be trained in every line of home-making. After all, the most attractive part of the home is the family who live in it.

The children, as Cornelius once said, are the most precious jewels, and in them lie the possibilities of mankind. Not for one moment can we afford to neglect this training for anything else. Just how old the child should be when this training should begin depends on the child. Few of us begin early enough. When the little one climbs up in the chair and wants to help wash dishes, or insists on sweeping the floor, often we are tempted to say, "Run along, you will break the dishes, or make more trash than you clean up." Right there the mistake is made, for if we continue to push them off they will cease to come and offer a helping hand, but will be content to go along and let mother do the work.

How proud mothers are of their domestic girls, and fathers of their sons

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who love the home and are willing to stay on the farm! And justly so. Our boys and girls should feel that they are a part of the home early in life, with some specific duty to perform each day.

To me one of the greatest responsibilities of child-training is their intense desire to do as *we do* and not as we *say do*. An instructor on one occasion was making a bed for a little one, charging her to imitate her the next morning and be very careful and not leave one thing undone. By accident, one of the pillows was knocked out of the window, where it had been placed while the bed was being made. On the following morning the little one showed she had grasped many of the instructor's suggestions, and with a few aids here and there the bed was ready for the pillows. She went to the window and deliberately knocked one out saying, "You thought you'd catch me, but you see I remembered you knocked yours out and I've done it too." This is often the case: we are imitated in the wrong place; so it behooves us to always be on the alert.

Some one has said housekeepers are born, not made. While we know this is not always true, we realize every day that to make our daughters proficient requires time and patience. Often a careless boy or girl will awake by watching nature; interest the children in growing flowers. They will relieve you and it will be such a pleasure to them to know they are doing something toward beautifying the home.

The country home where love and contentment reign is one to be envied, the home that belongs to the whole family, each one trying to make it a perfect one, each one looking after the comfort and pleasure of the other.

The country school teacher can plant many seed in the young mind that will be carried home. Interest the children in beautifying the schoolhouse and grounds, and soon you will see the fruit of your labors developing in the homes.

Pin Money Possibilities on the Farm.

MISS LINDA CLEMENT.

The chiefest source of a woman's farm revenue has always been her eggs, chickens and butter. One is almost justifiable in believing that a man who will carry to market, dispose of and pocket the price, provided his wife's labor was expended in the production of these articles, is nothing short of a — —. At any rate, the average farmer isn't guilty—there are few grafters in the profession, and almost to a man they consider it a privilege to make possible an earning capacity for wife and daughter. If they are progressive farmers, nothing short of the best material finds a lodging place on their farms, and if the women are going in for fowl culture nothing save a thoroughbred flock shall mark the beginning.

A venture in poultry designates chickens as the original flock. The disposition one intends to make of them would influence the selecting of a breed. If you wish to grow broilers or friers, you want a heavy, fat chicken which grows off rapidly; if you wish to gain your profit from eggs, you would choose one of the slender-bodied laying strains. A reputable poultry journal is a very necessary part of the outfit, and an eye alert to market demands must supplement all other information gained. Keep an accurate account of expenditures for first year and do not invest in expensive equipment nor add too large a flock of turkeys, guineas or ducks until your experience with your small flock of chickens shows your selling price tallying or indicating a margin above cost of production. Too many poultry plungers fail because their original investments in tremendous flocks and costly furnishings haven't the stability and insurance of past experience to make them profitably go. After your small return has produced a result, you are in need of a consumer. Never sell through a commission firm; you are entitled to the entire profits. Develop your business capacity by hunting your own markets, and once found, make them regular customers by furnishing only extra select stock. Let them learn they can depend on you for promptness and straight

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dealing. Hotels and colleges hold yearly contracts with farm individuals for poultry, butter and eggs. If they demand two-pound chickens, assort yours and send them *only two-pounders;* if white eggs are their choice, send them only white ones and reserve your tans and creams for another market. In the commercial world, we are told, the distinguishing mark of an American is that "he wants what he wants when he wants it," and he is willing to pay the price of his whims and impatience. So never argue with a customer that he wants something else, but cater to his eccentricities and restlessness since he doesn't count the cost.

In marketing your eggs, pack in cartons bearing your name and trademark and build your reputation on that trademark. Never sell an egg that has been gathered longer than three days; do not market your dirty eggs, rots, spots or dwarfs.

Increase yearly with your profits your flock of birds. Keep those that are especially strong and have bred true to color, size and other favorable requirements. Adaptability of breed for purpose desired would also influence the person's selection of a cow, when considering the possibility of profitable returns from the milk or butter industry. Just any old cow is not a dairy cow. Select a Jersey, Holstein or any standard strain of butter or milk producer. Begin at the beginning—to use a hackneyed expression—and learn the business from the inside out and from the outside in. Send for a government bulletin or attend a four or five days government dairying demonstration taking place in your town or the neighboring. Learn the nutritive value of the foods you feed your cows and learn to keep a record of and make tests of your milk. Follow minutely government formula for perfect butter. and produce a creamery variety which the year round nets you thirty-five cents a pound instead of the poorer product which retails at ten or fifteen cents. Remember there is no profitable return in money value in producing an inferior grade of anything.

The tomato clubs that have recently been organized in nearly all parts of the State, with a desire and hope of increasing the "Pin Money Possibilities" on the farm, may prove delusive unless the strictest regard is given to the instructions sent out by those who are in charge of this work. The best of tomatoes, the best methods of putting them up and absolute cleanliness should be strictly adhered to. If these essentials are disregarded the country may be threatened to become glutted with canned goods that the trade nor the consumer will want. If on account of this off-grade stuff the prices should drop to 60 or 75 cents per dozen, which is not improbable, the business could not be considered at all remunerative. It would pay far better to not can tomatoes at all, or only enough for home consumption, than to put them up at a loss. The farm woman finds sufficient for her hands to do without unprofitable or superfluous labor. But the woman on the farm who puts up only good stock and receives one dollar and twenty cents per dozen for her entire canned output is declaring a dividend, and she'll declare a still larger if she's a human market barometer. She'll grow two crops of tomatoes, and like some of our big peach, apricot and cherry producers, her canning outfit will be insurance for that part of the crop which fails a raw market. A store tomato, the standard canning variety, is a midsummer ripener and can not be successfully forced for an extremely early market. From my own personal experience I prefer a Langdon Earliana, a variety which has been on the market six or seven years. My Langdons, under conditions both favorable and unfavorable, have ripened from one week to ten days earlier than the standard earlies, and were ready for market when Florida tomatoes were still bringing fifty cents a basket.

To one interested in a canned goods market, a variety of fruits and vegetables rather than a dependence on just one, as the tomatoes, means more in profitable returns and finds readier sales. Of the vegetables maturing within the season in which planted, the English green pea, when properly canned, brings the most substantial price, ranging from $1.60 to $2 per dozen. Canned asparagus holds a market, at a price above other vegetables, and on a par

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with most of the California fruits. It requires three summers for an asparagus bed to reach maturity if grown from seeds. Still, when one considers that when once established it lasts indefinitely, the cultivation and patient waiting is worth the while. All asparagus for canning should be bleached and all stalks should be of a uniform size and length. If your canned product meets all market requirements, you should receive from $2.50 to $3 per dozen for your asparagus. Select varieties of peach, apricot, pears and berries commanding a good market at high prices, home-canned goods do not have to compete with canning factories, for they are always preferable and command, therefore, a better price. But, remember, just any old stuff you sling together doesn't find a waiting market. Grade everything you sell; use only perfect fruits and vegetables either for the raw market or cans. Build your reputation on perfection of flavor, cleanliness and honest weight. Specialize, if you care to, on some one fruit or vegetable, but be sure it's one the market isn't easily satiated with—fig preserves, sweet pickled figs, sweet pickled cantaloupes or peaches—something of this kind.

A Virginia woman built a factory from a tiny kitchen, and a fortune from a paltry investment, not only because by intuition she discerned that "Pin Money Pickles" would tickle the palate of a nation, but because every pickle she afterwards produced partook in size, flavor and perfection of that first delectable. Reputations are sometimes acquired by accident, but it's another thing to live up to them, and the rule holds good in a commercial sense.

In the profitable realm of the vegetable world there are waiting opportunities with the expenditure of a few cents for seeds, good earnest labor for cultivation, hard common sense for markets, and the farm woman need be no beggar. Earning one's spending money gives woman a confidence and added respect in and for her own capabilities. There are each day avenues multitudinous opening for the feminine farmer who would and will earn her way. There are bee farms, flower beds, early transplanted plants, lettuce farms, and home-made dainties galore. The "bide at home" woman has proven her capacity, and her profession will continue to grow.

It Pays to Think.

LUCIE T. WEBB.

The thinking farmer is the one who is making good today. It is he who considers the effect of every lick; who studies his soil and by the use of modern methods, with an equal amount of labor, increases the yield from two to fourfold. It is the thinking woman who accomplishes in one day by thought and system what her neighbor does in two. Yet how few of our women think. They go into the day's work with an indistinct idea of the myriads of things to be done, jumbled together, with no plan, no outline in the mind's eye; no grouping of tasks so that two and three things may be done at the same time; no regard for short cuts and easy ways; and, most of all, with no consideration whatever for their own strength and physical endurance. They stand through countless opportunities to sit and rest the tired feet. They trot from one place to another in an aimless way, making many trips where one should answer. All because they do not think.

A woman's life on the farm at its best is hard; how hard no one but the one who has lived it without hired help knows. Much of the drudgery can not be eliminated, even by a world of system. There are meals to cook, dishes to wash, beds to make, floors to sweep, milk to churn, vegetables to gather, fruit to save, water to bring, and sometimes, I am sorry to say, wood to cut, pigs to feed, and cows to milk. This is hardly a beginning of the daily tasks that confront her; and when there are babies to care for I often wonder that she is alive to tell the story. Surely then, if there is any help to be had in thinking, the farm woman needs to *think*. Else she can not greet her tired husband when night comes with a well-kept home, good food, and, best of all, a cheery smile.

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Conditions are different in every home, therefore the woman herself must study these conditions and solve her own problems the best she can. Let her have ever before her the one thought—*save steps*. Children are great step-savers for mother; the exercise and training is good for them. Not hard work for the little ones, but they enjoy seeing "who can pick up mamma's thread first," or "who can bring a spoon from the dining-room the quickest." A large waiter is also a great help, almost an entire meal can be carried to the table at one trip, or all of the dishes brought in from the dining-room when ordinarily one goes back and forth a number of times. Take the waiter to the pantry and while resting a minute on the meat box make a calculation of all the things needed in preparing the meal and, piling them on the waiter, carry them all to the kitchen at one time. Now rest again, this time in the kitchen rocking chair, and calculate how many steps you have saved. A small table can be placed close to the kitchen stove on the left-hand side and on it kept a jar of lard, some sugar, salt, pepper, a knife, fork, spoon, stove-lifter, etc.; this keeps one from going back and forth across the room to the kitchen table. Again, a wheelbarrow may be used to advantage in hauling stove-wood, one trip bringing enough to last a whole day. Or taken to the garden for vegetables, often this saves a half-dozen journeys. By all means, have the garden near the back of the house. I know I have, in days gone by, walked hundreds of miles to a garden off from the house out of reach of the chickens.

There are other ways, at a small expense, the housewife may save herself an untold amount of labor. A kitchen sink at a cost of from three to five dollars will be worth its weight in gold. A fireless cooker, an oil stove, linoleum on the kitchen floor, and where it can be done, a convenient water supply could be had in most of our homes if the housewife started in with the determination to *have them*.

As a parting word let me say, *save your feet*. Every woman will say her feet are more tired than anywhere else when night comes. Then she should sit down and work whenever it is possible; and in the winter, if the kitchen stove is the only chance to warm them, put a warm brick under each foot as she peals the potatoes, wipes the dishes, or picks the chicken.

Factors That Will Enter Largely Into the Betterment of North Carolina Agriculture.

A. L. FRENCH.

Every thinking citizen of North Carolina realizes the importance of our premier industry—agriculture. From the west line of Cherokee County to where the waters of Old Ocean beat upon the thin strip of land at the lower end of Currituck, that divide them from those of Albemarle Sound, men and women are found busily engaged in winning a living, and something for a rainy day, from the soil.

These men and women are our leading citizens; for they are engaged in the most important industry of ours, or any other State. And the young men and women that are, in the next generation, to take up and carry on the work of their fathers and mothers on the land are the most important factors that will enter into the betterment of the State's agriculture.

How important then that the training of these young lives be along lines that will enable them to dignify the work of their fathers and improve upon it to the degree that the increase of the world's population demands.

This training the writer believes should be the work first of the fathers and mothers on the farm. They should be trained from their infancy in the need for a better care of the soil and its more economical handling. Then as they arrive at school age the State should, while training them to develop their minds, strive to keep ever before them the principles that their parents have planted and tended before they were given into the State's keeping.

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This means an agricultural education for every boy and girl that is raised upon the farms of the State; an education, by the way, that unfits them in no way for any other business that they may choose to take up later; for a brain training founded upon the great principles that pertain to the soil will be one of the best foundations upon which to rear an educational structure that will fit for any other business or profession. And the hope of the country as I see it is to make of farm boys and girls farmers first, then let the surplus go to other callings; for the greatest need of our State today is better farmers. The greatest work that lies at the door of these better farmers of the future is the improvement of the soils of our State; for it is a fact that while our gross income from the lands of the State amounts to vast sums yearly, yet not half of the acres upon which our products are produced—because of a depleted condition—pay a living wage to the men handling them. This can mean nothing else than poverty to the farming people. And a people continuing in poverty generation after generation lose courage and ambition, and a consequent lowering of their standard of living and citizenship is inevitable.

This condition among those responsible for the care of our greatest industry can never be tolerated. Our new farmers must study and experiment until they learn how—by better drainage, better tillage, better fertilization, more economical working, and a better handling of necessary capital—to put these border acres into the profit-giving column; make them produce a greater yield each year at no greater expense, and cause them to increase from year to year in natural stored-up fertility. And then will the present generation be more economically fed and clothed and the heritage of future generations be conserved.

These young men and women of the future must be brought to realize clearly that upon them rests very largely the conservation of our great natural resource called water-power; for while the State and nation in the coming years may spend vast sums of the people's money in reforesting the mountains and building great reservoirs for the control of surplus water, yet upon them—the men and women having the control of the farming lands of the State—must fall the great bulk of the work of regulating the flow of surplus water.

The farming lands of the State must be so thoroughly underdrained, so well broken, so completely filled with vegetable matter, and the rougher portions of the farms so constantly covered with grass that surplus water will—the greater part of it—be made to seep through the land and thus leave gradually, rather than to rush off the surface of the soil to swell the creeks and rivers to the bursting point.

Upon the farmers and their wives of the future will fall in a large degree the work of beautifying our State, cultivating her natural resources, for beauty that is second to no State in the Union. Our unsightly patches of cultivated lands must be broadened and lengthened until they meet, forming broad areas of well-tilled fields. Our unprofitable, brush-grown gullies and galled hills must be made to lend beauty to the landscape by presenting an unbroken expanse of rich green, profit-giving grass. And upon these pastures the unlovely scrub animal must give place to the man-moulded, beautiful, well-bred cow, horse, sheep, and hog.

The farm homes of these future farmers will reflect their culture and prosperity, and the open country from Currituck to Cherokee will give abundant evidence that our State has recognized the importance of her greatest natural resource—the soil—and has given thought to the training of the people in the land; has given to agriculture the dignity that its importance warrants.

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Variations in High Yielding Varieties of Cotton.

JAMES M. GRAY.

In this report the records for the year of 1903 and 1909, inclusive, of the North Carolina Test Farms have been used. Most of the information is from the Iredell and Edgecombe farms, but the records from the Red Springs farm were used for the three years this farm was in operation (1903-1905).

In the experiments, from which the data for this report were gathered, the fertilizers used were the same on each farm. A 7—2½—2½ formula was used practically all the way through the series. The preparation of the land and the subsequent cultivation was the same in each instance. The land was broken with a two-horse plow eight to ten inches deep early in the spring and harrowed just before planting. The cultivation was frequent and shallow.

On the Edgecombe farm the land is a Norfolk Sandy Loam, varying in depth from 6 to 24 inches, with an average depth of about 12 inches. This soil holds manure fairly well and gives a yield of about a bale and a quarter of cotton without heavy fertilization. The seasons are of good length for the maturing of cotton.

The lands of the Red Springs farm are similar to those of the Edgecombe farm, Norfolk Sandy Loam, but less fertile naturally. The season is somewhat longer and warmer than at the Edgecombe farm. These two farms have approximately ideal conditions for cotton growing.

The soil of the Iredell farm is almost entirely Cecil Clay with some Clay Loam. The seasons are rather short for cotton, the farm being on the extreme northern border of the cotton belt. Commercially, cotton is not grown in this section to any great extent.

In this report the following varieties will be used for comparison: Russell's Big Boll, Culpepper's Improved, King's Improved, Excelsior Prolific, Edgeworth, Cook's Improved, and Simpkins's Improved. As will be seen, the Edgeworth variety was the only variety run through a series of six years on more than one farm. This irregularity in the tests made prevents the conclusions from being as definite as they might otherwise have been.

DESCRIPTION OF VARIETIES TESTED.

Russell's Big Boll is a hardy, large bolled and vigorous cotton that yields well on a loam or sandy soil in Eastern North Carolina. It is very popular with the pickers because of the ease and rapidity with which it can be picked. Under average conditions this variety is not only prolific, but fairly reliable. During a seven years test with the above mentioned varieties it stood third on the Edgecombe farm, giving an average yield of 462.72 pounds of lint per acre.

Culpepper's Improved, a large bolled variety, is about ten days earlier than Russell's Big Bolled. It has a large weed with spreading limbs, well bolled and holds cotton well. It is more variable than is Russell's Big Boll, but, notwithstanding this, in the seven years test it stood second on the Edgecombe farm with an average production of 471.97 pounds of lint per acre.

King's Improved has a smaller boll than either of the aforementioned varieties but runs a little higher in per cent of lint, averaging on the three farms 38.16 per cent for the seven years test. It has a rather small stalk with spreading limbs fairly well fruited.

Excelsior Prolific has large, deep lobed leaves and short, well matured limbs that bear a rather small boll of high percentage of lint. It often runs above 40 per cent lint, but because of its variability the average would be somewhat under this. On the Edgecombe farm it gave an average yield of 528.86 pounds, leading all others.

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Edgeworth has a rather heavy stalk, is short limbed with large leaves and is rather late in maturing. It runs about 34 per cent lint.

Cook's Improved has large plants, heavily limbed, the lower limbs very long and open; bolls medium size but long, slender and tapering; rather late in maturing. The percentage of lint for a period of six years averaged 39.02. This cotton seems to give a slightly higher per cent of lint on heavy soils than on light soils.

Simpkins's Improved is a small stalked, short limbed variety; a rather heavy fruiter, mediumly early maturing; but maturing at one time rather than continuously, and for this reason is not very well liked where there is a scarcity of pickers. The bolls are small and do not hold the lint very well.

The following table gives the yearly yields of these different varieties of cotton on the different test farms of the State covering a period of seven years.

	1903	1904	1905	1906	1907	1908	1909
Russell's Big Boll:							
Edgecombe Farm	554.53	409.44	616.36	682.61	328.07	362.50	287.52
Red Springs Farm	367.87	291.32	199.05				
Iredell Farm		224.32	279.39				289.85
Culpepper's Improved:							
Edgecombe Farm	425.83	368.51	671.72	699.30	373.40	313.30	451.71
Red Springs Farm	456.87	343.45	237.51				
Iredell Farm		217.04	276.36	335.25	198.10		351.19
King's Improved:							
Edgecombe Farm	323.91	541.51	667.59		344.30	324.80	448.95
Red Springs Farm	355.45	330.28	198.23				
Iredell Farm		247.85	400.69	317.18	350.60	509.70	373.12
Excelsior Prolific:							
Edgecombe Farm		592.86	623.87	719.10		265.50	443.00
Red Springs Farm	335.70	383.41	216.57				
Iredell Farm		168.39	296.88	316.56		359.00	342.00
Edgeworth:							
Edgecombe Farm		598.86	577.59	525.60	401.80	288.10	357.02
Red Springs Farm		332.52	182.41				
Iredell Farm		221.31	268.58	307.28	233.70	359.00	320.32
Cook's Improved:							
Edgecombe Farm			674.36	681.87	519.60	374.40	469.85
Red Springs Farm			278.21				
Iredell Farm			284.05	352.78		455.00	291.75
Simpkins' Prolific:							
Edgecombe Farm					342.80	341.50	426.75
Red Springs Farm	*						
Iredell Farm						402.40	360.03

*Farm discontinued 1905.

From a study of these figures it will be seen that there is a rather wide range of variations in yields of each variety on the same soils and on different soils. It is natural that there should be some variation on soils of different types, but it seems rather striking that there should be such a wide variation on the same soil when the culture and the fertilizers were the same. The climatic changes would, of course, affect the crops of different years somewhat, but hardly enough to justify such a wide variation. The fault would seem to lie with the seed more than anything else. Presumably not enough care was taken in the selection of seed and the quality of seed used.

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The following table will help to bring out the variation more forcefully:

	Edgecombe Farm	Year	Red Springs Farm	Year	Iredell Farm	Year
Russell's Big Boll:						
Highest yield	682.61	1906	367.87	1903	289.85	1909
Lowest yield	287.52	1909	199.05	1905	224.32	1904
Difference	395.09		168.82		65.53	
Culpepper's Improved:						
Highest yield	699.30	1906	456.98	1903	351.19	1909
Lowest yield	313.30	1908	237.51	1905	198.10	1907
Difference	386.00		219.47		153.09	
King's Improved:						
Highest yield	667.59	1905	355.48	1903	509.70	1908
Lowest yield	323.91	1903	198.23	1905	247.85	1904
Difference	343.58		157.25		261.85	
Excelsior Prolific:						
Highest yield	719.10	1906	383.41	1904	359.00	1908
Lowest yield	265.50	1908	216.57	1905	168.39	1904
Difference	453.60		166.84		190.61	
Edgeworth:						
Highest yield	625.60	1906	332.52	1904	359.00	1908
Lowest yield	288.10	1908	182.41	1905	221.31	1904
Difference	337.50		150.11		137.69	
Cook's Improved:						
Highest yield	681.87	1906	278.21	1905	455.00	1908
Lowest yield	374.40	1908	*		284.05	1904
Difference	307.47				170.95	
Simpkins' Improved:						
Highest yield	426.75	1909	†		402.40	1908
Lowest yield	341.50	1908			360.03	1909
Difference	85.25				42.37	

*One year only. †Farm discontinued.

A study of this table shows that on the Edgecombe farm there was a much wider range of variation than on either of the others, the Red Springs farm coming second and the Iredell farm giving the least variation. Although the test on the Edgecombe farm gave the widest variations, they also gave the greatest aggregate yield for the period over which the tests were run. This would teach that, if one could obviate this wide variation and still retain the high yielding quality of some of the best varieties of cotton, the section of country adjacent to the Edgecombe farm would be the greatest cotton section of the State. It is entirely possible that this can be done by a system of careful seed selection.

Another striking contrast brought out by these figures is the comparison of yields for the same year on the Edgecombe and Iredell farms. With the exception of Culpepper's Improved, all the varieties gave their largest yields on the Iredell farm the same year that they gave their smallest yields on the Edgecombe farm. Just why this should be is not known. The season of 1908 was very late and this may have affected the growth of cotton more

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on the Edgecombe farm than on the Iredell farm, since the cotton was planted on the Edgecombe farm several weeks earlier than on the Iredell farm. And, again, the quality of the seed might have contributed to this difference as seed were not from the same source.

Just here it might be interesting to note the averages of the different varieties on the same soil and on different soils. The following table will aid in this comparison.

	Average for all Farms	Average for Edgecombe	Average for Red Springs	Average for Iredell
Russell's Big Boll	337.77	462.72	286.08	264.52
		7 yrs.	3 yrs.	3 yrs.
Culpepper's Improved	361.16	471.97	345.95	265.58
		7 yrs.	3 yrs.	5 yrs.
King's Improved	367.67	441.84	294.65	366.52
		6 yrs.	3 yrs.	6 yrs.
Excelsior Prolific	379.10	528.86	311.89	296.56
		5 yrs.	3 yrs.	5 yrs.
Edgeworth	339.11	474.83	257.46	285.04
		6 yrs.	2 yrs.	6 yrs.
Cook's Improved	362.70	468.01	278.21	345.87
		5 yrs.	1 yr.	4 yrs.
Simpkins' Improved	375.78	370.35		381.21
		3 yrs.		2 yrs.

From first glance the difference as brought out by this table would not amount to so very much: in the average for all the farms there is only a difference of 41.33 pounds between the highest and the lowest; on the Edgecombe farm there is a difference of just 157.71 pounds; on the Red Springs farm the difference is 88.48 pounds, and on the Iredell farm the difference is 116.69 pounds between the highest and the lowest yielding varieties. On studying these figures more closely this difference is of decided importance when they are applied to the actual production of cotton in the State or on the individual farm. Just to illustrate: in North Carolina there are about 1,624,000 acres in cotton. If the whole acreage had been in Russell's Big Boll, which gave the lowest average, instead of Excelsior Prolific, which gave the highest average, the loss to the State would have been $7,955,040. (Allowing the price of cotton to be 12 cents.) Again, suppose the average farm contains fifty acres of cotton, and that the lowest yielding variety is being planted in each locality, the difference between Simpkins's Improved (the lowest) and Excelsior Prolific (the highest) was 158.51 pounds per acre; this would have resulted in a loss of $951 for each farm adjacent to the Edgecombe farm. The difference between Edgeworth, the lowest, and Culpepper's Improved, the highest, was 88.48 pounds per acre on the Red Springs farm, which difference would result in a loss of $531 on the adjacent farms. The difference between Russell's Big Boll, the lowest, and Simpkins's Improved, the highest, was 119.69 pounds per acre on the Iredell farm. This difference would amount to a loss of $695 to the man who planted Russell's Big Boll on farms adjacent to the Iredell farm. Of course these examples are extreme because no variety is planted exclusively. Yet if a farmer, by knowing the adaptations of a variety, can save from $500 to $1,000 on a fifty-acre farm, a study of varieties and their adaptation to different sections and different soils and fertilization is of very great importance.

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VARIATIONS IN PER CENT OF LINT.

Continuing a study of the same varieties as were used in the study of variations in yields it will be seen that there is also a variation in per cent of lint, both on the same soil and on different soils. This can be shown best by following the same methods as were used in showing differences in yields, namely, tables.

	1903	1904	1905	1906	1907	1908	1909	Aver.
Russell's Big Boll:								
Edgecombe Farm	32.39	34.39	31.75	32.56	31.23	31.95	24.90	31.31
Red Springs Farm	34.38	32.81	35.70					34.27
Iredell Farm		35.05	34.98				34.10	34.71
Culpepper's Improved:								
Edgecombe Farm	31.62	35.83	33.07	35.26	31.08	33.80	36.60	33.89
Red Springs Farm	37.50	37.50	37.39					37.19
Iredell Farm		34.45	34.98	34.42	35.37		34.60	34.75
King's Improved:								
Edgecombe Farm	36.60	39.20	38.21		35.08	37.40	35.70	37.03
Red Springs Farm	39.05	40.62	39.61					39.76
Iredell Farm		37.84	37.10	39.19	36.52	37.92	37.50	37.68
Excelsior Prolific:								
Edgecombe Farm		36.56	35.42	40.93		36.21	41.20	38.06
Red Springs Farm	37.50	40.62	39.61					39.21
Iredell Farm		35.45	37.58	39.49		37.09	38.00	37.52
Edgeworth:								
Edgecombe Farm		35.37	33.33	33.99	32.10	32.81	34.40	33.66
Red Springs Farm		35.94	37.15					36.54
Iredell Farm		36.58	35.34	35.21	34.88	37.21	35.20	35.73
Cook's Improved:								
Edgecombe Farm			37.09	39.03	39.09	38.61	40.20	38.80
Red Springs Farm			40.89					40.89
Iredell Farm			40.87	37.61		39.71	38.90	39.27
Simpkins' Improved:								
Edgecombe Farm					35.99	36.68	39.30	37.32
Red Springs Farm	*							
Iredell Farm						37.61	37.70	37.65

*Farm discontinued.

By looking over the column of averages it will be seen that without exception the average per cent of lint for all the varieties was higher on the Iredell farm than on the Edgecombe farm. It will also be noticed that with only one exception the percentage was higher on the Red Springs farm than on either of the others. True, the Red Springs tests were only continued three years. The Edgecombe farm, by reason of its rich soil, its long season and other natural advantages is the nearest ideal for cotton production of the three farms, Iredell farm, because of its short season, heavy soil, cool springs, is the poorest farm for cotton production of the three. Then why this decided difference in per cent of lint in favor of the Iredell farm? It is known that lint consists largely of carbon and that carbon comes through the leaves of the plant. Cotton on the Edgecombe farm suffers greatly from leaf rust, sometimes almost stripped of leaves; on the Iredell farm leaf rust is almost unknown. The natural supposition would be that the cutting off of the leaf area and consequently the amount of carbon in the plant limits the percentage of lint. There has been no investigation along this line, so this is a mere supposition. Yet it would appear that the farmer can well consider the rust resistant properties of his cotton.

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A comparison of the lint production and the yield does not seem to show that there is any relation between the per cent of lint and the yield of any one variety on the same soil or on different soils. To illustrate: In 1905 Russell's Big Boll gave a yield of 616.36 pounds of lint per acre on the Edgecombe farm with a percentage of lint of 31.75, while in 1908 it gave a yield of 362.5 pounds per acre with a percentage of 31.95. In 1905 Russell's Big Boll gave a yield of 279.39 pounds per acre on the Iredell farm with a percentage of lint of 34.98. In 1909 it gave a yield of 289.85 pounds of cotton per acre with a percentage of lint of 34.10. By comparing the other varieties in the same way it will be found that they bear out this same fact.

The following table will help to bring out some other contrasts in the variation in per cent of lint of the different varieties under discussion:

	Edgecombe Farm	Year	Red Springs Farm	Year	Iredell Farm	Year
Russell's Big Boll:						
Highest percent	34.39	1904	35.70	1905	35.05	1904
Lowest percent	24.90	1909	32.81	1904	34.10	1909
Difference	9.49		2.89		.95	
Culpepper's Improved:						
Highest percent	34.60	1909	37.50	1904	35.31	1907
Lowest percent	31.08	1907	37.39	1905	34.42	1906
Difference	5.52		.11		.95	
King's Improved:						
Highest percent	39.20	1904	40.62	1904	39.19	1906
Lowest percent	35.08	1907	39.05	1903	36.52	1907
Difference	4.12		1.57		2.67	
Excelsior Prolific:						
Highest percent	41.20	1909	40.62	1904	39.49	1906
Lowest	35.42	1905	37.50	1903	35.45	1904
Difference	5.78		3.12		4.04	
Edgeworth:						
Highest percent	35.37	1904	37.15	1905	37.21	1908
Lowest percent	32.10	1907	35.94	1904	35.20	1909
Difference	3.27		1.21		2.01	
Cook's Improved:						
Highest percent	40.20	1909	40.89	1905	40.87	1905
Lowest percent	37.09	1905	*		37.61	1906
Difference						
Simpkins' Prolific:						
Highest percent	39.30	1909	†		37.70	1909
Lowest	35.99	1907			37.61	1908
Difference	3.31				.09	

*One year. †Farm discontinued.

This table brings out the fact that with the same variety there is a greater variation in the per cent of lint on the Edgecombe farm than on either of the others. The most striking difference is with Russell's Big Boll and Culpepper's Improved. Just why this should be is unknown as no records were kept of the growth of these varieties on the different farms. This table again emphasizes the fact that a variety that does best on one soil or in one locality will not always do best on a soil of different character or in another locality.

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GENERAL CONCLUSIONS.

1. That there is a rather wide variation in yields of varieties of cotton on the same soil and on different soils.

2. That this variation regulates the profit or loss of a cotton crop more than most farmers realize.

3. That this variation can be regulated to a large extent by the farmer himself if he will study the adaptation of a variety to his own farm conditions, both as to soil and climate.

4. That, from the knowledge at hand, the variations of one variety on any particular soil can be regulated by a careful and systematic field selection of seed, and only by this method.

5. That, under present conditions, it is of far more importance to the farmer for him to study his field conditions, his variety of cotton and seed selection, etc., than it is for him to try to regulate the market price of cotton. He has been, is, and will be primarily a producer, and not a regulator of market prices. When he better understands the economic production of cotton under his conditions he can better undertake the regulation of markets.

6. That until the best variety of cotton for a particular farm or locality has been established, and the variations of this variety eliminated as far as possible, there need not be very much emphasis laid on the per cent of lint that a variety produces.

7. That after the best variety has been established and the controlable variations eliminated it will be well for the increase of the lint to be considered. But I believe that this will automatically increase and establish itself as the other changes are brought about.

8. That there is no variety that can be called the best variety universally.

9. That there is no variety that can be called the best variety for any particular soil or locality.

10. That the establishing of varieties for any particular type of soil, climate or locality is a great work that can be helped materially by the Experiment Stations but must be worked out finally by each individual farmer for his individual conditions.

Feeding Hogs in North Carolina.

BY DAN T. GRAY, CHIEF IN ANIMAL INDUSTRY.

The Southern people are large meat consumers but small meat producers. In fact, the South consumes more meat per capita than any other section of our country, but a large proportion of this meat is shipped into the South from other sections of the country. This is a very strange condition of affairs when all persons who have studied the question agree that pork can be made as cheaply, and perhaps more cheaply, in the South than in any other section of America.

There are many reasons why North Carolina farmers should introduce this line of animal production into their farming system. In the first place, very little capital is required to make a reasonable start: one hundred dollars invested in hogs represents a rather large beginning, but the same amount of money invested in some of the larger animals would be almost no start at all. In the second place, the sow is a rapid producer; each sow will produce no less than twelve pigs a year if she is given proper care and attention; this means that the money invested in hogs works rapidly. In the third place, the returns begin to come back within a very short time—which is an exceedingly important point for the man with limited capital. In the fourth place, the hog can not be surpassed for its ability to build up the soils rapidly, especially when leguminous crops are grown to supply the pasture.

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CORN WHEN FED ALONE IS NOT SATISFACTORY.

The majority of our farmers feed too much corn. It is generally considered that there is no other feed equal to corn for pork production. This is true, provided the corn is used judiciously. But if it be fed alone for any length of time there are few feeds which are poorer. If, however, corn is fed in combination with other feeds, its use is to be highly commended, and it can be used to great economical advantage, too, even though it sells upon the market as high as $1 a bushel.

The hog is not adapted to living on corn alone, and when we require it of him we are forcing him to do a thing which is not consistent with his nature. Man likes a mixture of feeds or a change in diet; so do the lower animals. The hog in its wild state is omnivorous, feeding upon roots, nuts, fish, grass, snakes, etc.; in fact, but few feeds can be mentioned that he will not eat if he be given the opportunity. Our domesticated hogs have inherited the tendency to select their feed from a variety of substances, and when we enclose them in a pen and give them but one feed we can feel assured that we are not allowing them to reach their highest possibilities.

Experimental data, as well as the experience of our best farmers, show that pork can not be profitably raised and finished upon corn alone when corn sells for 70 cents a bushel. The man who tries to finish hogs on corn alone is following a losing business. There are plenty experiments to show that when corn is worth 90 cents a bushel the cost of each pound of gain will be just about 9 cents; when corn is selling at 80 cents a bushel each pound of gain put on will cost 8 cents; when corn is worth 70 cents a bushel each pound of gain will cost 7 cents; and when corn is worth only 60 cents a bushel pork can be finished for only 6 cents a pound. It appears, therefore, that when 90-cent corn is fed to 7-cent hogs the feeder is losing 20 cents a bushel on his corn. Eight-cent pork must go along with 80-cent corn if the owner is to strike even on feeding corn alone. As a general thing the farmers do not get 8 cents for their hogs. If corn were worth but 40 cents a bushel, as it often is in some of the Western States, it would be a very profitable thing to raise corn and feed it to 6 and 7-cent hogs; good money could be made out of it, as the farmer would then be selling his 40-cent corn, by means of hogs, at 60 and 70 cents a bushel. But even in the corn-belt States it is more profitable to supplement the corn with other concentrates or green crops, and this practice is followed by the best farmers.

CONCENTRATES TO SUPPLEMENT CORN.

Fortunately for the South, it is not necessary to depend upon corn alone, as almost all the crops which can be grown in any part of the country can be grown in the South, and there are many crops suitable for hog feed which can be grown in no other section of the country. This section is wonderfully blessed in its great variety of grain and concentrates, and, in addition, green and pasture crops can be made to spread over twelve months of the year. In fact, with the use of pasture crops the South is in a position to make pork cheaper than any other section of the United States.

As stated before, the hog likes a variety of feeds and thrives better upon a ration made up of two or more feeds than upon one made up of but one. It has been proved by several of the experiment stations that wheat and corn, when fed separately to fattening hogs, are practically equal in feeding value. At the Wisconsin Experiment Station several tests were made to learn the relative value of wheat and a mixture of wheat and corn in equal parts. It was found that 500 pounds of wheat were required to make 100 pounds of gain, but when wheat and corn were fed in equal parts only 485 pounds of the mixture were required to make the same gain. When fed separately, these grains are of equal feeding value, but the mixture of the two was more valuable than either grain when fed alone. While the South has not the wheat, yet the Wisconsin experiments teach the lesson that if the most is to be realized upon the hog and the corn a supplementary feed must go along with the corn.

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Among the high-priced concentrated feeds that may be used along with corn and cheapen the ration are skim milk, wheat shorts, and tankage; these three are popular in the South, and are probably the cheapest and best. While the writer was at the Alabama Agricultural Experiment Station, he used all three of these feeds along with corn. The following table illustrates some of the average results:

TABLE 1—FEEDS TO USE WITH CORN.

Experiment	Ration	Average Initial Weight Each Pig	Average Daily Gain Each Pig	Feed to Make 100 Pound of Gain	Cost to Make 100 Pounds of Gain
1	Corn alone	65 lbs.	.39 lbs.	764 corn	$9.55
	Corn 2/3			339 corn	
	Shorts 1/3	60	.83	169 shorts	7.28
	Corn, 1 part			296 corn	
	Skim milk, 2 1/5 parts	60	1.33	666 skim milk	6.36
2	Corn alone	45	.12	874 corn	10.93
	Corn, 8/10			293 corn	
	Tankage, 2/10	45	.84	73 tank.	5.12
	Corn, 9/10			475 corn	
	Tankage, 1/10	45	.51	53 tank.	7.00

In the above financial estimate, corn is valued at 70 cents a bushel, wheat shorts at $36 a ton, skim milk at 40 cents a hundredweight, and tankage at $40 a ton.

In a general statement it may be said that it always paid to supplement the corn with wheat shorts, skim milk, and tankage, the skim milk proving to be the best and cheapest. Throughout all of the above tests the hogs which were fed on corn alone made exceedingly unsatisfactory gains, gaining in one case as low as one-tenth of a pound daily; larger hogs, however, would have done better. The hogs which were fed on one of the supplements along with the corn made satisfactory gains, those which drank skim milk giving almost remarkable results when compared with the results obtained when corn alone was employed.

It should also be noted that the gains were very expensive when corn was fed by itself, in one case going as high as $10.93 for each hundred pounds of pork made. In the second case above the expense of fattening the hogs was more than cut in half when one-fifth of the ration was made of tankage. In the first test the wheat shorts and the skim milk both saved much corn and cheapened the ration.

PASTURE CROPS TO SUPPLEMENT CORN.

The facts so far presented show one thing clearly—when corn is used alone as a hog feed money is almost sure to be lost. It has also been shown that the feeding value of corn is increased as a result of the use of almost any supplement. But even when corn is assisted by the supplementary feeds mentioned, there are but few cases where 70 cents is realized for a bushel of corn; that is, when hogs sell for six to seven cents a pound live weight. Under present conditions the Southern farmer must see his way clear to realize at least 70 cents a bushel upon his corn when fed to hogs before he can look upon the hog business as a profitable one. In short, concentrated feeds of all kinds are upon such a high level of prices that the farmer can

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not afford to limit the feed of the hog to them alone. Help must be sought outside the concentrated feeds.

The supplementary feeds heretofore mentioned, together with several others, are all good and should be used in hog-feeding operations; but the future of profitable hog production in the South depends upon the use of green or pasture crops. It is possible for the Southern farmer to have grazing crops practically the year through, and many of the best farmers have them. The Southern farmer has, in fact, a decided advantage over the Northern farmer in this respect. We have seen that a variety of feeds almost always produced more satisfactory results than one feed. Pastures and green crops can be used to furnish variety better than any other feeds. The Southern farmer has grown so accustomed to placing his hogs in a small pen when fattening period arrives that he has almost forgotten that the hog can make valuable use of many green crops if he be given the opportunity.

PERMANENT PASTURES.

Until the farmer sees his way clear to make a permanent pasture or has one already made, he should keep out of the live-stock business. It is, in fact, almost impossible to realize a profit upon any kind of stock without good pastures. Therefore, the first thing to be done when one contemplates engaging in stock raising is to establish a pasture.

The South, which is the very section where they can be made easily, is sadly deficient in pastures. No attention has been given to them; it has all been given to cotton. But the Southern farmer, if he will devote some time and effort to the subject, can have as good a pasture as was ever seen in Kentucky or Missouri, and have that pasture available for grazing more months in the year than is possible in those States. For a permanent pasture there is no combination, either in the North or in the South, that will equal burr clover and Bermuda grass. In many sections the Bermuda can be grazed throughout the summer months and the burr clover from January until the Bermuda comes on again. The combination will afford grazing at least ten months of the year. Both plants are permanent after they are once established. To supplement the permanent pasture, temporary pastures should be grown, as cowpeas, peanuts, etc., but no farmer who has stock can afford to be without this permanent pasture combination to be ready for use when the temporary pastures can not be employed.

RAPE PASTURE.

One of the valuable green crops for hogs is rape. It can be sown in the fall after the summer crops are taken off the land, and within seventy days is ready for the hogs to be turned upon it. It is a winter growing crop, or one that can be used between the two summer crops. As a result of its use the land can be kept in use and covered with green vegetation the year round. Several experiment stations and farmers have demonstrated its value as a hog feed.

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TABLE 2—RAPE AS A WINTER CROP FOR HOGS.

Lot	Ration	Average Daily Gain	Feed to Make 100 Pounds Pork	Cost to Make 100 Lbs. of Pork		Value 1 Acre Rape in Terms of Corn and Shorts
				Grain	Grain and Pasture	
1	Corn, 2/3	.84	320 corn			
	Shorts, 1/3		160 shorts	$6.88	$6.88	
2	Corn, 2/3 } 1/2 ration		172 corn			
	Shorts, 1/3 }		86 shorts			
	Rape pasture	.74	.15 acre	3.70	4.90	$21.20
3	Corn, 2/3 } 1/4 ration		110 corn			
	Shorts, 1/3 }		55 shorts			
	Rape pasture	.54	.22 acre	2.37	4.13	20.49

In the above financial estimate corn is valued at 70 cents a bushel, shorts at $36 a ton, and rape pasture at $8 an acre.

The work was done in Alabama, but the results are entirely applicable to North Carolina, especially the coastal region. This rape crop was sowed after soy beans, on September 21, on a sandy soil. The seed came up well and the hogs were turned on to the pasture November 9 and kept there until April 7, when they were taken off and sold. Five 100-pound pigs were grazed on each acre.

The test shows rape to be an exceedingly valuable winter crop; it saves much corn and other high-priced grains. In fact (see last column above) each acre saved sufficient grain to be worth $21.20 in one case, $20.49 in the other case, while the acre of rape did not cost over six dollars. In the lots where the rape pastures were employed, the cost of making gains in weight was very materially smaller than in the lot where dry feeds alone were fed. It cost $6.88 to make 100 pounds of increase in live weight in Lot 1, where corn and shorts were fed alone. In lots 2 and 3, where rape pastures were grazed, the grain cost to make equal gains was reduced to $3.70 and $2.37, respectively. When the expense of planting and cultivating the pastures is also added to the cost of the pork (see column 6), the total cost of making 100 pounds of increase in live weight in Lots 2 and 3 was raised to $4.90 and $4.13; the hogs in Lots 2 and 3, therefore, were fattened at an entirely satisfactory profit, while the ones which were finished on corn and shorts in a dry lot, were fattened at a loss, or at least, at an unsatisfactory profit. Rape provides an excellent winter pasture, but other pastures may be used with just about as satisfactory results. Rye, oats, barley, or burr clover may be used to very great advantage.

PLANTS FOR SUMMER PASTURE.

The pigs which are born in late winter and early spring should be finished for the market, or for home killing, the following fall or early winter. It will seldom pay to keep them through the first winter. When the pig is sucking the mother, both should be given the run of a pasture crop in order that grain may be saved. If the pig is born in late winter, any of the crops heretofore mentioned can be used until the summer crops begin to come on. When green crops and pastures are thus used, the pig can be gotten up to weaning time as cheaply, perhaps more cheaply, than he can be carried from weaning time to a finish. When the pigs are from 60 to 75 pounds in weight they are ready to begin to finish, and this is the time that the summer pasture crops should be ready to use. This date will be from August to September.

Any reasonably good farmer should experience no difficulty in providing summer and fall pasture crops, as he may take his choice from among cowpeas, peanuts, soy beans, rape, etc.

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Many farmers and stations have found cowpeas to be an excellent crop for hogs, although no one claims that they afford as much grazing to the acre as do peanuts and soy beans. At the Mississippi station cowpea pasture was grazed without grain. In 1903, although the crop was grown on thin land, one acre of cowpeas produced 350 pounds of pork. In 1904 the crop was grown on good valley land and produced 483 pounds of pork to the acre. The hogs were turned on the crop when the peas were ripe. Better results would no doubt have been secured if the animals had been given the run of the field about two weeks before the maturity of the peas.

In 1906 the Mississippi substation turned 8 sows with their 30 pigs into a red clover pasture of 3½ acres on March 20, the red clover having been sown the previous fall. This furnished ample grazing until August 20, when they were turned into a 4½-acre lot of corn and peas. The 30 pigs were killed out of this pasture November 1 without the addition of any other feed and dressed 117 pounds each, at an average age of 196 days. The pigs ate approximately 6 bushels of corn each. When land rent is estimated at $5 an acre, corn at 70 cents a bushel, and the cost of seeding the red clover is also taken into account, each pig cost $4.98.

It is getting to be a common practice in the Middle States, where cowpeas thrive well, to plant the peas in the corn at the last cultivation and graze the hogs on both crops. This method saves a great amount of labor, and the waste of corn is very small indeed if small pigs are given the run of the field after the fattening animals are taken off; in fact, the loss of corn is not as great as is usually the case when hired help gathers it.

Probably soy beans and peanuts afford the very best obtainable summer, fall, and early winter grazing crops. This, at least, has been the writer's experience. These two crops may be planted in the early part of the summer and be ready for grazing from 80 to 100 days after planting; this, however, depends upon the variety of seed used, the character of soil, etc. Anyway, if they are planted upon the same date the soy beans should be grazed first and the peanuts immediately afterward.

The following tests show how valuable these two crops are:

TABLE 3—PEANUTS AND SOY BEANS AS PASTURES FOR HOGS.

Experiment	Ration	Average Daily Gains	Feed to Make 100 Pounds of Pork	Cost to Make 100 Lbs. of Pork		Value 1 Acre in Terms of Corn Saved
				Corn	Corn and Pasture	
1	Corn alone	.38	609 corn	$7.61	$7.61	
	Corn, 1/4		68 corn			
	Soy bean pasture	1.1	.22 acres	0.85	2.59	44 bu.
	Corn, 1/2		138 corn			
	Soy bean pasture	1.0	.2 acre	1.73	3.36	41 bu.
	Corn, 3/4		175 corn			
	Soy bean pasture	1.3	.12 acre	2.19	3.17	63 bu.
2¼	Corn alone	.33	776 corn	9.58	9.58	
	Corn, 1/2		134 corn			
	Peanut pasture	1.25	.13 acre	1.68	3.08	65 bu.
	Corn, 4/5 Tank., 1/5 } 1/2		111 corn			
			28 tank.	1.95	2.96	34 bu.
	Peanut pasture	1.42	.13 acre			476 lb. tank.
	Peanut pasture	1.00	.22 acre		1.76	62 bu.

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In the above financial estimates corn was valued at 70 cents a bushel, the pastures at $8 an acre, and the tankage at $40 a ton. In some places peanuts should be valued at a very much higher figure than the one used here; if so, the reader can easily make the necessary changes.

These two pastures were both used to very great advantage, and pork was made at a very low cost when compared with the expense when corn was used by itself. When corn was used alone, it cost over 7½ cents to make each pound of pork; when soy-bean pastures were employed the expense was cut down to $2.59, $3.36, and $3.17 to make each 100 pounds of pork in Lots 2, 3, and 4, respectively. When peanut pasture was grazed it cost from $1.76 to $3.08 to make 100 pounds of pork when the pasture was valued at $8 an acre. The hogs were profitably fattened even when the peanuts are valued at $24 an acre.

FINISHING HOGS AFTER PASTURE CROPS ARE EXHAUSTED.

The majority of the farmers of the South who make use of green crops for fattening hogs, dispose of the animals when the crops are exhausted, without finishing them upon grain for a short period in a dry lot. There is a time when the hog should be penned up in a lot and fed grain alone, but that time is not at the beginning of the feeding operations. He should be penned up after the pasture crops are gone and fed grain alone for a few days before slaughtering or marketing. There are several reasons for following this plan. First, the hog, after coming off the pasture, is in just the proper condition to make gains economically and rapidly for a short time. He is in excellent health, active, and, as a rule, his frame is not covered with as much fat as it should carry. The pasture has tended to develop his frame at the expense of fat, especially if he is a young animal. After he is fed in a pen twenty-five to twenty-eight days, he looks better, and is better, than when he came off the pasture, and is actually worth more to the consumer or butcher, as he is fatter and will dress out a higher percentage of good marketable meat than if he had been sold directly from the pasture. Second, when hogs have been grazed upon peanuts, soy beans, and certain other green crops, the meat and lard have become soft, which makes the animal objectionable to the butcher as well as for home consumption. This soft meat can be hardened very materially if the hogs are fed upon grain for only a short period after the crops are exhausted.

What shall the animal be fed during this short dry-lot finishing period? Corn is good; corn in combination with cotton-seed meal is better and is cheaper than corn alone, as the addition of cotton-seed meal to the ration renders the meat hard more rapidly than when corn alone is used. If the animals are to be fed not more than twenty-one days in this finishing period, one-third of the total ration may be made up of cottonseed meal. If it is likely that the last period will be extended over more than twenty-one days, the proportion of cottonseed meal should be cut down to one-fifth or one-sixth of the whole ration, and the finishing period extended not beyond five weeks in all.

A Remedy for Cottonseed Meal Poisoning.

BY W. A. WITHERS.

I presume that it will not be necessary in the presence of so many good, practical farmers to devote much time to the discussion of the danger which accompanies the feeding of cottonseed meal to swine in large amounts, and for very long periods

Many of you no doubt know from sad experience that sometimes a fine porker fed upon cottonseed meal has been found dead in the morning which appeared perfectly well the previous evening. Sometimes this unfortunate ending may be anticipated from the refusal of the animal to consume the feed. On the other hand, some pigs seem to be highly immune and can eat the meal for long periods and without harmful effects, apparently.

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The symptoms of cottonseed meal poisoning which generally have been observed may be briefly stated as follows: When the pig begins to refuse cottonseed meal, he usually shows very rapid, short, shallow breathing, an anæmic condition which shows in the paleness of the mouth, skin and elsewhere, imperfect vision, and even blindness, and a weakening of the muscles of the legs. If the pig is exercised very violently, death usually ensues quickly. A post-mortem examination always shows an œdematous condition of the lungs, and sometimes there is inflammation of the digestive tract.

Many investigators in America and abroad have studied the problem with a view to ascertaining the cause of toxicity and means for overcoming it. The various theories which have been advanced as to what the poisonous substance is, have all been discarded. Lest you throw aside as erroneous the explanation and remedy which we have to offer, I shall endeavor, without going too much into the technical side, to give you an outline of the steps involved in our work, so that you may know the facts which we observed and draw your own conclusions from them.

These experiments were conducted jointly by the Chemical, Veterinary, and Animal Husbandry Divisions of the Agricultural Experiment Station. As Belgian hares, or rabbits, are killed by cottonseed meal in about two weeks, our preliminary experiments were conducted with them instead of with swine, as it takes about twelve weeks to kill the latter. There is also a saving in expense by using the hares.

A feed may be deleterious or harmful to an animal from several causes: (1) from purely mechanical action such as stopping the intestines, lacerating them, etc.; (2) by not having in it the constituents which are necessary for maintaining the life of the animal; or (3) by having in it some true poison, that is some substance which may be taken into circulation in the blood of the animal and thereby interfere with the physiological processes of the body. We may quickly dismiss the idea of injury in a mechanical way, as there has not been an indication of stoppage of the intestines or of irritation by mechanical means. The remedy for an incomplete or improperly balanced feed would be to increase the missing constituent, and the remedy for a poison would be to remove it before feeding or to change it into an insoluble form so that it would be inert in the body of the animal.

Coming back to the symptoms exhibited by the animals fed on the cottonseed meal, we find that they compared fairly well with those exhibited by animals that have had some soluble sulphide added to their feed. These produce death by acting upon the blood, and diminishing its power of carrying oxygen until death ensues. Some soluble iron salt naturally suggests itself as an antidote. In our experiments with rabbits, we fed one gram of cottonseed meal daily for each 100 grams of live weight. This corresponds to one pound daily for each 100 pounds of live weight of swine, or 10 pounds daily for each 1,000 pounds of live weight of beef or dairy cattle. This will be recognized as rather heavy feeding. The meal was mixed with molasses to make it more palatable. Green feed was given one each day in the form of cowpea vines or cabbages. The rabbits were confined in galvanized iron cages, so as to keep them under close observation.

We began feeding five rabbits with the cottonseed meal. At the end of 14 days, two had died, one was sick, and all had lost in weight. At that time we began adding a solution of citrate of iron and ammonia to the feed. The sick rabbit recovered and all three rabbits gained in weight for the next 14 days, at which time the experiment was discontinued. We took another rabbit which had only eaten 75 grams of cottonseed meal during five weeks and added iron solution to his feed. This rabbit at once began to eat the meal, and after the first week continued to eat all the meal supplied him and gained in weight for five weeks, at which time the experiment was stopped. These four rabbits testify that an iron salt will make them well after they have been made sick by cottonseed meal.

We took 22 rabbits and fed them with cottonseed meal at the rate referred to, and all died after an average of 13 days, some of them going as early as

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the sixth day and only one enduring so long as 22 days. These 22 rabbits show that cottonseed meal is poisonous.

We began feeding 8 rabbits the same amount of cottonseed meal with all the conditions the same as above, except that an iron salt was added to the feed. We fed 3 of them 64 days, 3 of them 91 days, and 2 of them 106 days, and discontinued the experiment. Each of them remained normal during the whole period, and each ate all the cottonseed meal given. The iron salt enabled them to withstand any deleterious effects of the cottonseed meal, from three to five times as long as the hardiest rabbit could endure the meal without the iron salt. Clearly these 8 rabbits testify to the fact that iron salt kept the meal from making them sick.

We took 3 rabbits that had eaten all the meal given to them for 64 days when an iron salt was mixed with it, and had remained normal during the whole period. At that time we ceased adding the iron salt to their feed. After a few days some of them began to refuse some of their feed, and all of them died in 23 days. Here 3 rabbits testify that an iron salt will make cottonseed meal harmless, and if taken from the feed the meal begins to show its harmfulness.

To sum up these experiments, 27 rabbits show the poisonous effects of cottonseed meal and 12 show the efficiency of an iron salt in preventing or overcoming its poisonous properties, and in each case the conclusion was clear and unmistakable.

Of course the practical herdsman is not interested in what may happen to rabbits, if the results apply to them alone. The question is, what about swine, or cattle, or sheep? We have not yet been able to undertake to test the efficiency of the iron as an antidote to cottonseed meal if fed to cattle or horses, but we have made some tests with swine. Twelve pigs weighing an average of 50 pounds each were taken and placed in two separate lots, each in a pen to himself. We began feeding to each daily one-half pound of cottonseed meal and 1½ pounds of corn meal. To one-half of the animals we gave in addition a solution of an iron salt. The feed was increased as the animals grew. No green feed was given, and the animal got only such exercise as was possible in a small pen. These conditions are not the best, of course, but we wished to make a severe test. On today,* which is thirteen weeks from the beginning of the experiment, four out of the six pigs receiving the cottonseed meal without an iron salt are dead. The other two have made an average gain of only 35 pounds and do not have a very thrifty appearance. On the other hand, the six pigs which received an iron salt with the cottonseed meal have gained an average of 54 pounds, or nearly half as much again as the straight cottonseed meal pigs. The pigs receiving the iron salt are in the best of condition.

Based upon these results, iron salt appears to be of value in diminishing, if not entirely preventing, the harmful effects to swine of cottonseed meal feeding, provided that feeding is not in excess of the rate of one pound of meal daily to each 100 pounds of live weight. It may be of value if the feeding is in larger amounts, but we prefer to confine our statements to the experiments already performed by us. Should an animal refuse his feed, if given cottonseed meal and an iron salt, I would suggest that the cottonseed meal be withheld from the feed for a few days, until the appetite of the animal returns, and then the meal feeding may be resumed. I should continue the feeding of the iron salt.

I have purposely withheld until the last, directions as to preparing and feeding the iron solution. The directions are so simple that one may easily remember them. Dissolve one pound of copperas (ferrous sulphate) in a barrel (about fifty gallons) of water. For each pound of cottonseed meal take one gallon of the solution, mix thoroughly daily for each 100-pound pig.

*On October 29, 1913, which is twenty-two weeks after the beginning of this experiment, five of the six pigs consuming cottonseed meal without copperas are dead, but all six of the pigs receiving copperas with the cottonseed meal are alive, gaining in weight, and apparently without any ill effects from the cottonseed meal.

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If the pig weighs only 50 pounds, use half the amount of cottonseed meal and one-half of the copperas solution.

Reorganizing the Farm.

J. M. JOHNSON.

A system of management which will give greater returns for labor and capital invested in farming in the Piedmont section of the South is needed. It is the western half of North Carolina in which this paper takes greatest interest. It is the agriculture in the section extending westward from the main line of the Seaboard Air Line Railway that shall be considered. In this section, according to the figures given in the 1910 census, the average farm grew crops annually to the value of $457.00. A study of farm soils, farm equipment, including implements and work stock, and of methods and practices in tillage, convinces one that the yields and values of the crops grown should be much higher than those represented in the census report. When the facts that one-third of the land classified as improved farm land is doing absolutely nothing in the line of growing valuable crops, and that only about one-fifth of the area under tillage gives annual harvests worth $20.00 or more per acre, while the crops on two-fifths are worth only $12.00 per acre and on two-fifths the crops are worth less than $8.50 per acre, is considered, the importance of a better system is recognized.

This system should give more acres of the crops of high value and fewer of those of lower. It should not eliminate crops already grown successfully; neither should it depend upon the introduction of new or untried ones. It should contain nothing of a doubtful nature. It should if possible offer opportunity of utilizing 100 per cent of the improved land in crop growing and in many cases perhaps make farming profitable enough to justify the clearing up or reclaiming good lands now in woods and thus make the farms large enough to allow of improved methods of tillage and so forth. The system should allow the average work animal kept on these farms to do more days of profit-bearing work per year than at the present.

In order that such a system of management and reorganization may be suggested it may be well to review conditions and practices as existing in 1909 and as yet practically unmodified throughout the Piedmont area.

For careful study we shall take the four counties, Chatham, Randolph, Davidson and Rowan, constituting the heart of western North Carolina, and having the soil and climatic conditions peculiar to the great stretch of Piedmont country from Virginia southward. The value of crops per farm in these counties is about 5½ per cent above the average for the Piedmont section of the State. Some farmers are making good profits, while others are losing money and a great many are practically meeting expenses, but returning no profits.

The lessons drawn from this study will be applicable in the western half of North Carolina, and, the writer believes, in the Piedmont section of the southeast.

In Chatham County in 1909 there were 3,646 farms with an average of 33.3 acres of improved land and 70.8 acres of unimproved land per farm; 23.3 acres of the improved land was planted to crops. These crops were worth $439.00 per farm. Ten acres of improved land per farm was uncultivated. The cultivated land grew crops to the value of $18.85 per acre. Had the 10 acres of improved land which was not planted been occupied in growing crops of only average value, the income on each farm should have been increased $188.50, or for the county, $687,271.00.

On the farms in the county were 5,301 work horses and mules. This is an average of 1.45 head of work stock for each farm, or one work animal for each 16 acres in crops. Had the entire 33.3 acres been planted there would have been one work animal for every 22.9 acres to be cared for.

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In Randolph County there were 4,011 farms averaging 36.1 acres of improved and, 71.9 acres of unimproved land per farm. Of the improved land 22.92 acres per farm were planted to crops which produced a cash value of $396.14 or $17.23 for each acre planted. There was an average of 13.18 acres of improved land per farm in this county unplanted. Had this produced only average crops the income per farm should have been increased $227.09 or for the county $910,858.00.

Randolph County had 6,462 head of work horses and mules, which is equivalent to 1.61 per farm or one for every 14.25 acres planted or for every 22.4 acres of improved land.

Davidson County reports 3,505 farms with an average of 41.9 acres of improved and 52.6 acres of unimproved land. Of the improved land 27.2 acres is planted to crops which yield a value of $502.17 per farm or $18.46 per acre cropped. There remains 14.7 acres of improved land, per farm, unplanted. Had this been devoted to crops yielding harvests of only average value per acre the income per farm should have been increased $269.36, or for the county $944,106.00.

In Davidson County there are 5,900 work horses and mules. This is 1.68 work animals for each farm or one such animal for every 16.2 acres cropped, or for 24 9 acres of improved land.

Rowan County has 3,241 farms with 44.1 acres of improved land and 45.1 acres of unimproved per farm. Of the improved land 32.9 acres per farm is planted in crops which give a harvest worth $617.95 or $18.78 for each acre planted. There remains 11.2 acres of improved land, per farm, unplanted. Had this made crops in value equal to the average of the cropped land, there should have been added to the income of each farm the sum of $210.33, or for the county this increase should amount to $681,679.53.

From figures given it seems a system of farming which would allow the utilization of every acre of improved farm land in the counties considered should add to the income of the average farm as follows: Chatham County, $188.50; Randolph, $227.09; Davidson, $269.36, and Rowan, $210.33, or a sum total of nearly three and a quarter million dollars for the four counties.

Is it possible for the farmers to reorganize their business on a basis to allow of such an increase in income without a corresponding growth in outlay or in operating expense?

In laying the foundation for the answer to this question a further study of present farm organiztaion embracing cropping systems now followed is necessary.

In Chatham County the average farm of 33.3 acres of improved land has 10.38 acres in corn; 3.8 in cotton; 5.04 in wheat; 2.13 in oats; .75 in hay and 1.22 in miscellaneous crops including tobacco. The average acre in cotton is worth $30.00, while that in corn is worth $12.00, wheat $7.00, oats $6.00, hay $22.00.

In Randolph County the average farm or 36.1 acres of improved land has 10.33 acres in corn, .44 in cotton, 7.39 in wheat, 1.70 in oats and 1.95 in hay. The average acre in cotton is worth $25.00; that in corn is worth $12.00; that in wheat $9.00; that in oats $7.00; in hay $20.00.

In Davidson County the average farm of 41.9 acres of improved land has 9.27 acres in corn; 1.66 in cotton; 8.80 in wheat; 2.01 in oats and 3.88 acres in hay. An acre of cotton is worth $24.00, while corn is worth $12.00, wheat $9.00; oats, $6.00, and hay, $25.00.

In Rowan County the average farm of 44.1 acres of improved land has 11.25 acres in corn; 6.1 in cotton; 7.15 in wheat; 3.05 in oats, and 4.17 acres in hay. Cotton is worth $24.00 per acre; corn $12.00, wheat $8.00, oats $7.00, hay $24.00.

The four counties under review have 14,403 farms. These farms average 38.6 acres of improved land. The unimproved land in farms averages 60.9 acres per farm. There are 1.65 work animals (horses and mules) per farm. Were the entire 38.6 acres devoted to farm crops, including hay plants, the

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average work animal would have 23.4 acres to care for. Under the conditions and practices prevailing in 1909 these farms had only 24.92 acres each devoted to crops. This means that the average work animal cared for 15.1 acres of land. Should the farmers expect more than this from one horse? Can they get more than this amount of productive work from each horse kept? These are points to be considered.

The crop system followed on the average of these farms called for 10.14 acres in corn and 2.87 acres in cotton; by adding .99 of an acre for miscellaneous spring planted crops to the above, there would be 14 acres of land per farm requiring breaking and preparing for spring planting. If this breaking is done with one-horse plows it should require from 16 to 20 days for one horse. All the harrowing given should not require more than four days. Laying off rows and putting down fertilizers should not take more than six days work for one horse. Six days again for bedding and planting brings the horse work on the 14 acres up to 36 days at the time the last seed goes into the ground. The time required to cultivate these crops should not exceed five days for one horse each time they are gone over. If they are worked five times in the course of the spring and summer a maximum of 25 days for a horse will be required after the crops are planted and by the time they are laid by. A liberal allowance at harvest and market time should call for not to exceed 10 days of horse work. Thus in making 14 acres of cultivated crops as grown per farm in 1909 may possibly demand 71 days of work for one horse.

This farm, though; has 7.1 acres in wheat, 2.2 in oats and 2.6 acres in hay; or a fraction less than 12 acres in all these crops. Fall preparation and planting is called for in case of the wheat and better yields may be expected from fall planted oats. These two crops occupy 9.3 acres. Allowing 20 days for one horse on wheat and oats and 9 days on the 2.6 acres in hay, we get a total of 100 days of horse work actually required in taking care of all the crop work on the average of these farms.

The farm has 1.65 work animals to do 100 days work per year. This means that the average work animal (horse or mule) does only 60 days of farm work per year. Is it reasonable to expect more than this from him? Will it pay his owner to exact more days work and more acres cultivated for each horse or mule?

Fortunately we have records on a number of farms in the Piedmont section of North Carolina which throw some light on this point. Let us look to one of these farms. On this farm we find 288 acres of crops grown; corn 100 acres; cotton 75; wheat 50, hay and miscellaneous crops making up the rest. Ten head of work stock taking care of all this, or an average of 28.8 acres for each horse or mule on the place. After every expense, including interest on the investment, is paid, this farm shows a clear profit of $2,900, or $290.00 profit for each head of work stock used. Other farms, some much smaller, show proportionately as good results.

It is reasonable to expect more than 60 days work from each horse or mule kept on the farm in the Piedmont section of North Carolina as well as other southern states. It should pay the farmer to exact more days of productive work from the work stock, and thereby make a greater quantity of valuable crops.

The farm should be organized to allow each head of work stock to care for a minimum of 23 acres of land in crops of commercial value. Such a system should call for not less than 100 days work per year from each head of work stock kept. In all probability the farm would be more profitable if 150 days of work at productive enterprises could be exacted from each horse. The South may not be ready for such a system at the present, but her farmers should begin to plan for it and gradually grow to it.

Doubtless it is more difficult to organize a small farm on the better basis than a large one. It is not easy to get more than 75 days of work annually for a horse at profitable enterprises on farms as now organized and grow

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from 15 to 16 acres of cultivated crops for each work animal kept. When these farms become organized on a basis calling for two-horse teams, with from 45 to 50 acres in cultivated crops per team, it will be an easy matter to get from 100 to 120 days of profit earning work for each head of work stock. The difficulties standing in the way of such organization are more apparent than real. The average farm no whas 23.4 acres of improved land per work animal. The system proposed will require the utilization of all this land. On a great number of farms only one horse is kept at the present. It will be wise for men working such places to exchange teams with one another a few days at the periods of heavy work, especially such as breaking land and harrowing it and also at harvest time. This will give each farm the advantages of a better prepared soil and the more efficient methods of cultivating and harvesting. Where two or more horses are already kept, these should be hitched into the double teams and used with bigger plows and other machinery necessary for good farming.

The organization of a two-horse farm having 50 acres of improved land may be as follows: 12 acres in cotton, 12 in corn and 12 in small grain, using wheat on a part and oats on the remainder, but proportioning the acreage of the respective grains to the needs and demands of the farm. The small grain should be followed by a crop of peas for hay. About 4 acres for all miscellaneous crops, and 10 acres for grass for hay and if there is no other grazing land a part of the grass may be used for pasture. For the one-horse farm the acre to each crop may be reduced proportionately.

The 24 acres for corn and cotton will be to plow after fall crop work is out of the way and before time to plant in the spring. After the land is plowed it should be harrowed, then the rows are to be layed off, fertilizers applied and perhaps in many cases bedded before planting.

A two-horse team with a turn plow will break approximately 1.75 acres in a day. Thus it may require 14 days to break the 24 acres. Another four days will be needed to do the harrowing. Six days with two horses should open all rows and put down the fertilizers. Six days again should do the bedding and planting. Cultivating these crops an average of five times should require not more than 35 days of horse work. Harvesting and housing the corn and cotton will require not more than one day of horse work per acre or 24 days for handling both crops. Allowing 12 days for all extra horse work, we have the 24 acres of corn and cotton made at an enpenditure of 131 days horse work.

The horse work required in caring for the 12 acres in small grain followed by peas for hay should not exceed 4 days per acre, or 48 days for the two crops. Allowing 25 days of horse work on the four acres of miscellaneous crops and 20 days on the permanent hay and pasture lands, we have a sum total of 223 days of horse work required on the 50-acre farm organized on the suggested basis. This is 111.5 days work for each horse instead of 60 days as by the system prevailing on the same farms in 1909 and which has not been greatly modified in recent years.

IMPORTANCE OF PROPOSED SYSTEM.

Under the system prevailing during the past few years the farmer cultivated 24.92 acres of land with 1.65 head of work stock and grew crops to the value of $482. Or one horse does the work on 15.1 acres, making crops worth $277. The average farm has 13.7 acres of improved land doing nothing, while 60.9 acres remain unimproved. The proposed system calls for the utilization of all the improved land in profit producing enterprises It will also call for bringing under cultivation of from 12 to 15 acres of the most fertile of the unimproved lands and the cultivating of this reclaimed acreage in valuable crops.

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Allowing the yields and values per acre of the respective crops to remain in years to come the same as in the past, let us see how the earning of the farm is affected:

Cotton, 12 acres, @ $26.40	$ 316.80
Corn, 12 acres, @ $12.00	144.00
Small grain—	
10 acres in wheat, @ $9.00 per acre	90.00
2 acres in oats, @ $6.00 per acre	12.00
Pea Hay, 12 acres, @ $20 per acre	240.00
Grass Hay, 10 acres, @ $23.38 per acre	233.80
Total, 46 acres crops value	$1,036.60

These figures are based on the supposition that the change in system would not tend to increase yield per acre of any of the crops now grown. This assumption is not entirely correct, as it is well known that a change from one-horse to two-horse farming, especially when accompanied by more liberal use of cow peas and other legumes in the rotation, is followed by increased yields from each and every crop grown. Increased yields with prices remaining stationary means increased income for the farm.

Under the system proposed the corn yields should average double what they are under the present. Cotton should be influenced in a like manner. Small grain yields should be increased from 50 to 100 per cent. Hay should make a very material increase.

After the proposed system has been in operation for a period of five years, the better farms of the two-horse or 50-acre class should show incomes of from $750 to $1,000 after all expenses are paid.

To some it may seem that there is too much land devoted to cotton for the amount of labor available at chopping and picking times. If conditions are not favorable to this portion of the land in cotton, it may be reduced without materially affecting the income, provided the right crops are substituted. The average acre of cotton under prevailing conditions is worth $26.40, while an acre of hay is worth $23.38. If half the cotton land be planted to hay crops of only average value, the farm income suffers a reduction of $18.12. The saving in labor and fertilizer would in all probability overbalance the difference in the value of the cotton dropped and the hay added to the cropping system.

Unless the yields of small grain and corn increase very materially, their acreage should not be increased, and it may be advisable to quit growing wheat and oats for grain, but to handle these as cereal hay crops. In either case every acre growing the wheat, oats or other small grain as a hay or grain crop should be planted to peas or other summer growing legumes as soon as possible after grain or cereal hay crops have been harvested. The summer grown crop of peas or other legumes may be harvested for hay, or if soil conditions and the needs of the farm are such as to justify they may be plowed under and thereby increase the yields of other crops in the pasture.

The secret of success lies in keeping all the tillable land busy in growing valuable crops and to have enough tillable land to give the teams profitable employment as many days as possible during the year. The cropping system should be such as to keep the available labor employed on profitable enterprises during as many months in the year as possible.

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INDEX

PAGE

State Board of Agriculture 2
Officers and staff 2
Letter of transmittal 3
Report of Farmers' Institutes, 1913 5
    Explanation of premiums offered at women's institutes 5
    Schedule of institutes held 6
    Lecturers and subjects 11
County and local Farmers' Institute organizations 13
    Chairmen of county and local committees 13
Officers State Farmers' Convention 17
Women's Institutes, 1913 18
    Schedule of institutes held 19
    Lecturers and subjects 23
County and local women's organizations 24
Program for Normal Institutes 29
Eleventh annual State Farmers' Convention and Round-up Institute 31
    Program of Farmers' Convention 33
    Program of Housewives' Convention 34
Some Things I have Found Helpful in My Home 35
The Country Home 40
Pin Money Possibilities on the Farm 41
It Pays to Think 43
Factors That Will Enter Largely into the Betterment of North Carolina Agriculture 44
Variations in High Yielding Varieties of Cotton 46
Feeding Hogs in North Carolina 52
A Remedy for Cottonseed Meal Poisoning 58
Reorganizing the Farm 61

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LEAF TOBACCO SALES FOR NOVEMBER, 1913.

Pounds sold for producers, first hand	24,954,002
Pounds sold for dealers	1,173,148
Pounds resold for warehouses	1,324,539
Total	27,451,689

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THE BULLETIN

OF THE

NORTH CAROLINA

DEPARTMENT OF AGRICULTURE

RALEIGH

Vol. 35, No. 2. FEBRUARY, 1914 Whole No. 193

VARIETY TESTS OF CORN

PUBLISHED MONTHLY AND SENT FREE TO CITIZENS ON APPLICATION.

Entered at the Postoffice at Raleigh, N. C., as second class matter.

February 7, 1901, under Act of June 6, 1900.

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*Assigned by the Bureau of Soils, United States Department of Agriculture.
†Assigned by the Bureau of Animal Industry, United States Department of Agriculture.
‡In co-operation with Bureau of Plant Industry, United States Department of Agriculture.

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LETTER OF TRANSMITTAL

MAJOR W. A. GRAHAM,
Commissioner of Agriculture.

DEAR SIR:—I am sending you herewith a manuscript discussing in a brief way the results of the variety test work done with corn on the Test Farms and at different points in the State during the past season. This work has been carried out according to plans made and inaugurated by J. L. Burgess, Agronomist in Cereal Investigations. The tables and other data have been arranged and the report written by G. M. Garren, assistant Agronomist in Cereal Investigations.

I recommend the publication of the manuscript as the February BULLETIN.

Respectfully submitted,

C. B. WILLIAMS,
Chief, Division of Agronomy.

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VARIETY TESTS OF CORN FOR 1913

By G. M. Garren, Assistant in Cereal Investigations.

Herewith is submitted the tables of the results of the annual tests of varieties of corn on the different Test Farms. This year there were six tests made, one each on the Buncombe Farm, the Iredell Farm, the Central Station at Raleigh, the farm of the Tobacco Station at Oxford, the Edgecombe Farm, and on land adjoining the black land farm at Winona. A severe storm September 3d so injured the crop at Winona that the results were lost altogether. Owing to an accident only a few of the varieties at the Oxford Station were saved and only partial data on these were possible. The weights of the cobs from the bushels of shelled corn were lost and this almost ruined the entire results. The yields of bushels of shelled corn per acre, upon which the rating of the varieties are based, were found by dividing the pounds of ears per acre by 70, the standard commercial number of pounds of ears of dry corn required to shell one bushel, instead of the actual number of pounds, found by weighing the corn when harvested, as was used in all the other tables. This gives, therefore, only an approximation instead of actual yields.

The tables in form are the same as those published in previous issues of the Corn Bulletin. They are, therefore, by this time fairly intelligible to all interested readers.

Under given conditions the largest yield of corn depends upon three things: the number of stalks on the land, the number of ears on the stalks, and the size and shape of the ears. By size and shape of ears is meant their shelling capacity, not mere bulk. Any attempt to supply artificially either one of these elements when defective or lacking altogether, destroys field conditions, under which all such tests have to be conducted to be of practical value. The only one of these elements that any reasonable attempt can be made to supply when lacking is that of stand. Perfect stands are almost unknown. Sometimes the stand of one variety is almost perfect; another along side of it very poor. Obviously it is very difficult to make a fair comparison of yields with such unequal stands. An effort has been made in the fourth column under head of "Yields Per Acre" to overcome this difficulty. Here the yields per acre have been calculated on the basis of a perfect stand. It is a mere calculation but gives a fair working idea of the actual differences in yields among the varieties. At the Buncombe Farm the stand was made perfect by supplying the missing stalks from another part of the plat. Obviously this method takes no note of whether the supplied stalks had the average number of ears or whether the ears were the average size. Neither does it take note of the average per cent of barren

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stalks. It is less reliable than the calculation methods. Like the latter, it only aids one to get an idea of the real differences in yields of the varieties when the stand is abnormal.

In Table I are recorded the results at the Buncombe Test Farm. The weights of the shelled bushels of corn are very low, far below the standard. The growing season in the mountains this year was unusually short. The frost struck the corn before it fully matured. Hence it is light and chaffy. Boone County, Whitson, Brooks' Pride, Golden Prolific, and White Majestic are the five highest yielders. Boone County and Whitson have the same rank. Whitson has fewer barren stalks and therefore really ranks first. It is a native corn and thoroughly acclimatized.

The results at the Iredell Farm are recorded in Table II. Only 26 varieties were tested and upon the whole it was the most satisfactory test of the whole year. Weekly's Improved, with 36 barren stalks out of a total of 281, ranked first in yield. It had been improved for two years in the grain-breeding work of the Division of Agronomy, and came from Selection No. 35, made in 1910. Being acclimatized and improved by seed selection explains in large part its high yield. Golden Prolific, Southern Beauty, Weekly's Improved (South Carolina grown) and Sanders' Improved make up the five highest yielders in this test.

The results at the Central Station at Raleigh are recorded in Table III. A larger number of varieties than at any of the other stations were tested here. First rank was taken by First Generation of Cross No. 182. This variety, along with several others, was furnished by the Bureau of Plant Industry at Washington. These varieties are designated by number and may be so recognized. This is the second year these varieties have been tested in the State, and the first time any one of them has taken the lead. Biggs' Seven Ear, one of the best prolific corns for Eastern Carolina, takes second place. Cocke's Prolific, another most excellent variety for Eastern Carolina, comes third. Golden Prolific and Marlboro's Prolific (Tennessee grown) make up the five highest yielders.

Table IV contains the results of the test at the Edgecombe Farm. Here the per cent of ears to stover is unusually high. The corn was blown down by the September storm and was not harvested till late in the season. Consequently all the stover was practically destroyed except the bare stalks. This is especially true of the early maturing varieties. Batts' Four Ear (Georgia grown), Weekly's Improved (North Carolina grown), Latham's Double, Weekly's Improved (South Carolina grown), and Parker's Prolific, all prolific varieties, are the five leading varieties in this test.

In Table V are found the results of the test on the farm of the Oxford Tobacco Station. Here Parker's Prolific, Cocke's Prolific, and Biggs' Seven Ear, the three leading prolific varieties of Eastern Carolina, and Hickory King and First Generation of Cross No. 182, two single-eared varieties, make the five highest yielders. But on account of a different and less accurate method of computation as noted above, this table is less reliable than any of the others.

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In Tables VI and VII are the compiled results of the tests of seven varieties for five years on the Iredell and Edgecombe Farms. Whenever a variety maintains the lead for five or more years, one is safe in concluding that that variety is well adapted to the locality in which it was grown. Any farmer living in the vicinity of the Iredell and Edgecombe farms can plant a pure acclimatized strain of Weekly's Improved or Biggs' Seven Ear, the leading variety of these respective farms, with a reasonable certainty of obtaining maximum results, so far as variety influences those results.

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TABLE I.—VARIETY TEST OF CORN AT THE BUNCOMBE TEST FARM IN 1913.

Varieties	Stalks Per Plat			Yield Per Plat		Yield Per Acre					Total Weight		Shelling Capacity			
	For Perfect Stand	By Actual Count	Barren Stalks	Pounds of Stover	Pounds of Ears	Pounds of Stover	Pounds of Ears	Bushels of Shelled Corn	Bushels of Shelled Corn With Perfect Stand	Pounds of Ears to Shell One Bushel	Per Cent. Stover	Per Cent. Ears	Per Cent. Grain	Per Cent. Cob	Weight of Measured Bushel of Shelled Corn	Rank According to Yield
Boone County	100	100	20	37	50.5	999	1,363.5	.....	23.1	59	42.2	57.8	65.2	34.8	47	1
Whitson	100	100	25	57	60	1,539	1,620	.....	23.1	70	48.7	51.3	80.0	20.0	56	1
Brook's Pride	100	100	14	60	51	1,620	1,377	.....	22.9	60	54.0	46.0	80.0	20.0	48	2
Golden Prolific	100	100	7	39	53.5	1,053	1,444.5	.....	22.5	64	42.1	57.9	81.2	18.8	52	3
White Majestic	100	100	6	52	51	1,404	1,377	.....	22.5	61	50.4	49.6	85.2	14.8	52	3
Latham's Double	100	100	4	55	47.5	1,485	1,282.5	.....	22.1	58	53.1	46.9	79.3	20.7	46	4
Deaton's Favorite	100	100	21	73	50	1,971	1,350	.....	21.9	62	59.3	40.7	80.6	19.4	50	5
Craig's Red Cob Prolific	100	100	9	55	53.5	1,485	1,444.5	.....	21.8	66	50.6	49.4	78.7	21.3	52	6
Batts' Four Ear (N. C. Grown)	100	100	20	53	49.5	1,431	1,322.5	.....	21.3	62	51.7	48.3	80.6	19.4	50	7
Selection No. 177	100	100	0	40	55	1,080	1,485	.....	21.2	70	42.1	57.9	82.8	17.2	58	8
Simpkins' Prolific	100	100	16	45	48.5	1,215	1,309.5	.....	21.1	62	48.0	52.0	80.6	19.4	50	9
Shenandoah White Dent	100	100	4	34	49	918	1,328	.....	21.0	63	40.9	59.1	82.5	17.5	52	10
Selection No. 170	100	100	26	71	43.5	1,917	1,174.5	.....	20.9	56	62.0	38.0	82.1	17.9	46	11
One Ear Corn	100	100	30	65	49	1,755	1,323	.....	20.6	64	57.0	43.0	75.0	25.0	48	12
Columbia Beauty	100	100	8	42	49	1,134	1,323	.....	20.6	64	46.1	53.9	81.2	18.8	52	12
Improved Southern Snow Flake	100	100	13	48	50	1,296	1,350	.....	20.4	66	48.9	51.1	81.8	18.2	54	13
Cross No. 176	100	100	0	52	51.5	1,404	1,390.5	.....	20.4	68	50.2	49.8	82.3	17.7	56	13
Biggs' Seven Ear	100	100	5	42	52.5	1,134	1,417.5	.....	20.2	70	44.4	55.6	77.1	22.9	54	14
Cross E-1XE-5	100	100	31	71	45.5	1,917	1,228.5	.....	19.8	62	60.9	39.1	77.4	22.6	48	15
Southern Beauty	100	100	5	39	45	1,053	1,215	.....	19.5	62	46.4	53.6	83.3	16.7	52	16
Weekley's Improved (N. C. Grown)	100	100	32	49	50.5	1,323	1,363.5	.....	19.4	70	49.2	50.8	77.1	22.9	54	17
Blount's Prolific	100	100	13	40	51.5	1,080	1,390.5	.....	19.3	72	43.7	56.3	80.5	19.5	58	18
Eureka	100	100	19	66	51	1,782	1,377	.....	19.1	72	56.4	43.6	75.0	25.0	54	19
Weekley's Improved (S. C. Grown)	100	100	16	70	46	1,890	1,242	.....	19.1	65	60.3	39.7	73.8	26.2	48	19
Summerour	100	100	0	76	51	2,052	1,377	.....	19.1	72	59.8	40.2	75.0	25.0	54	19

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Raleigh Prolific	100	100	8	44	49	1,188	1,323		18.9	70	47.3	52.7	77.1	22.9	54	20
Hickory King	100	100	2	44	44	1,188	1,188		18.8	63	50.0	50.0	83.1	16.9	53	21
First Gen. Cross No. 182	100	100	7	31	46	837	1,242		18.8	66	40.2	59.8	81.8	18.2	54	21
Crook's Prolific	100	100	32	52	42.5	1,404	1,147.5		18.5	62	38.0	62.0	74.1	25.9	46	22
Marlboro Prolific (Tenn. Grown)	100	100	0	47	48.5	1,269	1,309.5		18.1	72	49.2	50.8	75.0	25.0	54	23
Goodman's Prolific	100	100	1	46	44.5	1,242	1,201.5		18.1	66	50.8	49.2	81.8	18.2	54	23
Cocke's Prolific	100	100	0	42	46.5	1,134	1,255.5		17.9	70	47.4	52.6	77.1	22.9	54	24
Selection No. 187	100	100	35	53	50	1,431	1,350		17.7	76	51.4	48.6	76.3	23.7	58	25
Gerrick's Prolific	100	100	17	64	45	1,928	1,215		17.3	70	55.0	45.0	74.2	25.8	52	26
Parker's Prolific	100	100	13	41	46	1,107	1,242		17.2	72	47.1	52.9	77.7	22.3	56	27
Selection No. 138	100	100	39	35	42	945	1,134		16.2	70	45.4	54.6	77.1	22.9	54	28
Batts' Four Ear (Ga. Grown)	100	100	35	59	39.5	1,593	1,066.5		15.6	68	59.8	40.2	79.4	20.6	54	29
Selection No. 164	100	100	2	36	39	972	1,053		15.0	72	48.0	52.0	77.7	22.3	56	30

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TABLE II—VARIETY TEST OF CORN AT THE IREDELL TEST FARM IN 1913.

Varieties	Stalks Per Plat			Yield Per Plat		Yield Per Acre				Total Weight			Shelling Capacity			Rank According to Yield
	For Perfect Stand	By Actual Count	Barren Stalks	Pounds of Stover	Pounds of Ears	Pounds of Stover	Pounds of Ears	Bushels of Shelled Corn	Bushels of Shelled Corn With Perfect Stand	Pounds of Ears to Shell One Bushel	Per Cent. Stover	Per Cent. Ears	Per Cent. Grain	Per Cent. Cob	Weight of Measured Bushel of Shelled Corn	
Weekley's Improved (N. C. Grown)	230	281	36	206	203	4,738	4,669	66.7	52.9	70	50.3	49.7	80.0	20.0	56.0	1
Golden Prolific	230	266	13	177	196	4,071	4,508	64.8	55.6	69.5	47.4	52.6	82.7	17.3	57.5	2
Southern Beauty	230	227	6	165	158	3,795	3,634	57.6	58.1	63	51.0	49.0	84.1	15.9	53.0	3
Weekley's Improved (S. C. Grown)	230	231	43	175	165	4,025	3,795	53.4	53.1	71	51.4	48.6	76.0	24.0	54.0	4
Sanders' Improved	230	210	26	151	138	3,473	3,174	51.1	55.8	61.5	52.2	47.8	85.3	14.7	52.5	5
Biggs' Seven Ear	230	211	8	145	170	3,335	3,910	48.8	53.1	80	46.0	54.0	78.7	21.3	63.0	6
Latham's Double	230	190	17	193	138	4,439	3,174	48.0	57.9	66	58.3	41.7	80.5	19.5	54.0	7
Lippard's Selection	230	198	11	153	138	3,519	3,174	48.0	55.6	66	51.2	48.8	84.8	15.2	56.0	7
Cocke's Prolific	230	200	16	123	146	2,829	3,358	47.9	54.9	70	45.7	54.3	80.7	19.3	56.5	8
Columbia Beauty	230	210	10	156	135	3,588	3,105	47.4	51.7	65.5	53.6	46.4	83.9	16.1	55.0	9
Simpkins' Prolific	230	201	5	157	147	3,611	3,381	46.9	53.5	72	51.6	48.4	80.5	19.5	58.0	10
Gerrick's Prolific	230	213	46	211	140	4,853	3,220	46.0	49.4	70	60.1	39.9	77.1	22.9	53.0	11
Marlboro Prolific	230	188	16	139	136	3,197	3,128	42.8	52.1	73	50.5	49.5	80.8	19.2	59.0	12
Parker's Prolific	230	201	9	121	133	2,783	3,059	42.7	48.7	71.5	47.6	52.4	79.7	20.3	57.0	13
Batts' Four Ear	230	216	47	196	130	4,508	2,990	42.7	45.3	70	60.1	39.9	80.1	19.9	57.0	13
Craig's Red Cob Prolific	230	158	10	118	111	2,714	2,553	42.5	54.7	59.5	51.0	49.0	84.8	15.2	50.5	14
Blount's Prolific	230	200	6	129	130	3,067	2,990	40.4	46.4	74	45.9	54.1	82.4	17.6	61.0	15
First Gen. Cross No. 182	230	156	0	113	119	2,599	2,737	40.2	59.1	68	48.7	51.3	80.8	19.2	55.0	16
Summerour	230	191	21	81	118	1,863	2,714	37.4	44.8	72.5	40.7	59.3	80.0	20.0	58.0	17
Hickory King	230	185	10	143	103	3,289	2,369	36.4	45.0	65	58.1	41.9	86.1	13.9	56.0	18
Eureka	230	157	24	143	115	3,289	2,645	35.7	52.2	74	55.4	44.6	78.3	21.7	58.0	19
One Ear Corn	230	131	12	151	98	3,473	2,258	33.7	50.1	67	60.6	39.4	77.6	22.4	52.0	20
Goodman's Prolific	230	143	49	108	95	2,484	2,185	32.6	52.2	67	53.2	46.8	86.7	13.3	58.0	21
Deaton's Favorite	230	145	13	136	92	3,128	2,116	31.5	49.9	67	59.6	40.4	80.5	19.5	54.0	22
Cross E-1XE-5	230	138	22	143	86	3,289	1,978	29.0	48.3	68	62.4	37.6	79.4	20.6	54.0	23
Boone County	230	120	11	74	66	1,702	1,518	23.3	44.6	65	52.8	47.2	83.0	17.0	54.0	24

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TABLE III—VARIETY TEST OF CORN AT THE CENTRAL STATION IN 1913.

Varieties	Stalks Per Plat			Yield Per Plat		Yield Per Acre				Total Weight		Shelling Capacity			
	For Perfect Stand	By Actual Count	Barren Stalks	Pounds of Stover	Pounds of Ears	Pounds of Stover	Pounds of Ears	Bushels of Shelled Corn	Bushels of Shelled Corn With Perfect Stand	Pounds of Ears to Shell One Bushel	Per Cent. Stover	Per Cent. Ears	Per Cent. Grain	Per Cent. Cob	Weight of Measured Bushel of Shelled Corn	Rank According to Yield
First Gen. Cross No. 182	134	128	37	61	54	2,440	2,160	34.2	35.8	63	53.0	47.0	78.7	21.5	52	1
Biggs' Seven Ear	134	144	37	82.75	61.25	3,310	2,450	34.0	31.6	72	57.4	42.6	81.9	18.1	59	2
Cocke's Prolific	134	122	23	89.5	59.5	3,580	2,380	33.0	36.2	72	60.0	40.0	81.9	18.1	59	3
Golden Prolific	134	135	27	88.5	56.5	3,540	2,260	32.7	32.4	66	61.0	39.0	81.8	18.2	54	4
Marlboro Prolific (Tenn. Grown)	134	133	30	87	55	3,480	2,200	32.3	32.5	68	61.2	38.8	80.8	19.2	55	5
Simpkins' Prolific	134	131	29	85	54	3,400	2,160	30.4	31.0	71	61.1	38.9	81.6	18.4	58	6
Selection No. 177	134	118	19	74.25	50.75	2,970	2,030	29.8	33.8	68	59.4	40.6	85.2	14.8	58	7
Improved Southern Snow Flake	134	109	12	62.50	50.5	2,500	2,020	28.8	35.4	70	55.3	44.7	82.8	17.2	58	8
Selection No. 120	134	115	35	80.25	45.75	3,210	1,830	28.1	32.7	65	63.6	36.4	83.0	17.0	54	9
Southern Beauty	134	111	28	62.5	45.5	2,500	1,820	28.0	33.8	65	57.4	42.6	83.0	17.0	54	10
Selection No. 164	134	130	33	87.5	50.5	3,500	2,020	27.6	28.4	73	63.4	36.6	82.1	17.9	60	11
Selection No. 138	134	117	25	72.75	48.25	2,910	1,930	27.1	31.0	71	60.1	39.9	78.8	21.2	56	12
Batts' Four Ear (N. C. Grown)	134	142	37	92	48	3,680	1,920	27.0	25.4	71	65.0	35.0	81.6	18.4	58	13
Parker's Prolific	134	122	30	73.5	46.5	2,940	1,860	26.9	29.5	69	61.2	38.8	82.6	17.4	57	14
Hickory King	134	105	1	92	43	3,680	1,720	26.6	39.9	66	68.1	31.9	87.8	12.2	58	15
Eureka	134	117	36	93.5	48.5	3,740	1,940	26.2	30.0	74	65.8	34.2	79.7	20.3	59	16
Raleigh Prolific	134	127	24	86	46	3,440	1,840	29.9	27.3	71	65.1	34.9	81.6	18.4	58	17
Blount's Prolific	134	131	16	79.5	48.5	3,180	1,940	25.5	26.0	76	62.1	37.9	78.9	21.1	60	18
Weekley's Improved (N. C. Grown)	134	122	33	76	46	3,040	1,840	25.5	28.0	72	62.2	37.8	80.5	19.5	58	18
White Majestic	144	127	39	71.25	40.75	2,870	1,630	25.4	26.8	64	63.6	36.4	84.3	15.7	54	19
Crook's Favorite	134	119	47	72.5	43.5	2,900	1,740	25.2	28.3	69	62.5	37.5	79.7	20.3	55	20
Selection No. 181	134	141	46	111	44	4,440	1,760	25.1	23.8	70	71.6	28.4	82.8	17.2	58	21
Farley's Yellow Dent	134	123	33	63.75	46.25	2,550	1,850	25.0	27.2	74	57.9	42.1	78.3	21.7	58	22
Sander's Improved	134	109	36	75	41	3,000	1,640	24.1	29.6	68	64.6	35.4	83.8	16.2	57	23
Latham's Double	134	144	68	86.5	40.5	3,460	1,620	23.8	22.1	68	68.1	31.9	82.3	17.7	56	24

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Varieties	Stalks Per Plat			Yield Per Plat		Yield Per Acre				Pounds of Ears to Shell One Bushel	Total Weight		Shelling Capacity			
	For Perfect Stand	By Actual Count	Barren Stalks	Pounds of Stover	Pounds of Ears	Pounds of Stover	Pounds of Ears	Bushels of Shelled Corn	Bushels of Shelled Corn With Perfect Stand		Per Cent. Stover	Per Cent. Ears	Per Cent. Grain	Per Cent. Cob	Weight of Measured Bushel of Shelled Corn	Rank According to Yield
One Ear Corn	134	115	23	75.75	39.25	3,030	1,570	23.4	27.2	67	65.8	34.2	82.0	18.0	55	25
Goodman's Prolific	134	105	11	62.5	38.5	2,500	1,540	23.3	29.7	66	61.8	38.2	87.8	12.2	58	26
Cross No. 176	134	169	80	104.25	42.75	4,170	1,710	23.1	18.3	74	70.9	29.1	81.0	19.0	60	27
Craig's Red Cob Prolific	134	91	23	57	35	2,280	1,400	22.2	32.6	63	61.9	38.1	84.1	15.9	53	28
Brook's Pride	134	103	35	74	34	2,960	1,360	21.9	28.4	62	62.7	37.3	85.4	14.6	53	29
Columbia Beauty	134	104	26	61	36	2,440	1,440	21.8	28.0	66	65.9	34.1	84.8	15.2	56	30
Chappel	134	141	55	103.75	39.25	4,150	1,570	21.8	20.7	72	72.5	27.5	79.1	20.9	57	30
Selection No. 170	134	109	37	88.5	36	3,540	1,440	21.8	26.8	66	71.0	29.0	78.7	21.3	52	30
Deaton's Favorite	134	93	31	65	33	2,600	1,320	20.0	28.8	66	66.3	33.7	81.8	18.2	54	31
Shenandoah White Dent	134	100	30	56.75	34.25	2,270	1,370	19.8	26.5	69	62.3	37.7	81.1	18.9	56	32
Boone County	134	92	30	55.25	31.75	2,210	1,270	19.5	28.4	65	63.5	36.5	80.0	20.0	52	33
Batts' Four Ear (Ga. Grown)	134	142	44	102.5	33.5	4,100	1,340	19.1	18.0	70	75.3	24.7	82.8	17.2	58	34
Gerrick's Prolific	134	120	45	99	35	3,960	1,400	18.9	21.1	74	73.8	26.2	77.0	23.0	57	35
Rogers White Dent	134	111	17	91	33	3,640	1,320	18.8	22.7	70	73.3	26.7	82.8	17.2	58	36
Summerour	134	104	29	76	33	3,040	1,320	18.3	23.5	72	69.7	30.3	81.9	18.1	59	37

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TABLE IV.—VARIETY TEST OF CORN AT THE EDGECOMBE TEST FARM IN 1913.

Varieties	Stalks Per Plat			Yield Per Plat		Yield Per Acre				Pounds of Ears to Shell One Bushel	Total Weights		Shelling Capacity			Rank According to Yield
	For Perfect Stand	By Actual Count	Barren Stalks	Pounds of Stover	Pounds of Ears	Pounds of Stover	Pounds of Ears	Bushels of Shelled Corn	Bushels of Shelled Corn With Perfect Stand		Per Cent. Stover	Per Cent. Ears	Per Cent. Grain	Per Cent. Cob	Weight of Measured Bushel of Shelled Corn	
Batts' Four Ear (Ga. Grown)	315	354	50	214	206	3,638	3,502	46.6	41.2	75	50.9	49.1	84.0	16.0	63	1
Weekley's Improved (N. C. Grown)	315	307	47	181	209	3,077	3,553	44.9	45.9	79	46.4	53.6	82.2	17.8	65	2
Latham's Double	315	304	74	127	188	2,159	3,196	44.3	45.6	72	40.3	59.7	86.1	13.9	62	3
Weekley's Improved (S. C. Grown)	315	338	43	231	189	3,227	3,213	43.4	40.3	74	43.6	56.4	82.4	17.6	61	4
Parker's Prolific	315	292	46	142	193	2,414	3,281	43.1	46.3	76	42.3	57.7	81.5	18.5	62	5
Marlboro Prolific (Tenn. Grown)	315	337	87	208	197	3,536	3,349	42.9	40.0	78	51.3	48.7	82.0	18.0	64	6
Cross No. 176	315	281	14	369	181	6,273	3,077	42.1	35.9	73	67.0	33.0	84.9	15.1	62	7
Golden Prolific	315	311	53	125	185	2,125	3,145	41.9	42.3	75	40.3	59.7	85.3	14.7	64	8
Batts' Four Ear (N. C. Grown)	315	298	54	132	188	2,244	3,196	40.9	43.1	78	41.2	58.8	82.0	18.0	64	9
Raleigh Prolific	315	280	74	156	184	2,652	3,128	40.1	44.0	78	45.8	54.2	82.0	18.0	64	10
Goodman's Prolific	315	257	38	158	162	2,686	2,754	38.2	46.6	72	49.3	50.7	87.5	12.5	63	11
Cocke's Prolific	315	267	33	148	177	2,516	3,009	38.0	44.7	79	45.5	54.5	81.0	19.0	64	12
Simpkins' Prolific	315	287	63	94	176	1,598	2,992	37.8	41.2	79	34.8	65.2	82.2	17.8	65	13
Cross E-1XE-5	315	226	56	37	158	629	2,686	37.8	52.6	71	18.9	81.1	84.5	15.5	60	13
Gerrick's Prolific	315	298	24	152	168	2,584	2,856	36.1	38.1	79	47.5	52.5	79.7	20.3	63	14
Blount's Prolific	315	292	48	147	163	2,499	2,771	35.0	37.4	79	47.4	52.6	81.0	19.0	64	15
Summerour	315	287	26	145	155	2,465	2,635	34.2	37.4	77	48.3	51.7	83.1	16.9	64	16
One Ear Corn	315	241	10	102	148	1,734	2,516	33.5	43.7	75	40.8	59.2	81.3	18.7	61	17
Eureka	315	274	11	180	150	3,060	2,550	31.8	36.5	80	54.5	45.5	80.0	20.0	64	18
Biggs' Seven Ear	315	286	23	132	143	2,244	2,431	31.1	34.0	78	48.0	52.0	82.0	18.0	64	19
Improved Southern Snow Flake	315	241	37	34	126	578	2,142	30.1	39.0	71	21.2	78.8	80.2	19.8	57	20
White Majestic	315	235	31	76	119	1,292	2,023	26.9	34.6	75	38.9	61.1	85.3	14.7	64	21
Selection No. 170	315	186	13	102	108	1,734	1,836	26.6	45.0	69	48.5	51.5	81.1	18.9	56	22
Hickory King	315	247	31	109	106	7,303	1,802	25.0	31.8	72	50.6	49.4	84.7	15.3	61	23
Shenandoah White Dent	315	225	37	24	106	408	1,802	24.0	33.3	75	18.4	81.6	81.3	18.7	61	24

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TABLE IV.—VARIETY TEST OF CORN AT THE EDGECOMBE TEST FARM IN 1913—*Continued.*

Varieties	Stalks Per Plat			Yield Per Plat		Yield Per Acre					Total Weight		Shelling Capacity			
	For Perfect Stand	By Actual Count	Barren Stalks	Pounds of Stover	Pounds of Ears	Pounds of Stover	Pounds of Ears	Bushels of Shelled Corn	Bushels of Shelled Corn With Perfect Stand	Pounds of Ears to Shell One Bushel	Per Cent. Stover	Per Cent. Ears	Per Cent. Grain	Per Cent. Cob	Weight of Measured Bushel of Shelled Corn	Rank According to Yield
Crook's Prolific	315	209	20	26	104	442	1,768	23.8	35.5	74	20.0	80.0	78.3	21.7	58	25
Boone County	315	291	46	93	102	1,581	1,734	23.4	25.2	74	47.6	52.4	78.3	21.7	58	26
Southern Beauty	315	247	41	70	90	1,190	1,530	22.5	28.6	68	43.7	56.3	86.7	13.3	59	27
Selection No. 177	315	212	37	81	94	1,377	1,598	22.1	32.7	72	46.2	53.8	84.7	15.3	61	28
Deaton's Favorite	315	252	50	50	100	850	1,700	22.0	27.4	77	33.3	66.7	79.2	20.8	61	29
Craig's Red Cob Prolific	315	167	21	75	85	1,275	1,445	21.8	40.9	66	46.8	53.2	86.3	13.7	57	30
Columbia Beauty	315	171	6	91	89	1,547	1,513	21.5	39.3	73	50.5	49.5	83.5	16.5	61	31
First Gen. Cross No. 182	315	148	10	42	58	714	986	12.9	27.4	76	42.0	58.0	81.5	18.5	62	32

TABLE V.—VARIETY TEST OF CORN AT THE OXFORD TOBACCO STATION FARM IN 1913.

Parker's Prolific	158	187	31	58	61	1,972	2,074	29.6			48.7	51.3	88.5	11.5		1
Cocke's Prolific	158	162	19	53.5	60	1,819	2,040	29.1			47.1	52.9	73.3	26.7		2
Hickory King	158	171	19	60	59.5	2,040	2,023	28.9			50.2	49.8	89.0	11.0		3
Biggs' Seven Ear	158	172	24	60	58	2,040	1,972	28.1			50.8	49.2	77.5	22.5		4
First Gen. Cross No. 182	158	150	18	37	57	1,258	1,938	27.6			39.3	60.7	81.5	18.5		5
Cross No. 176	158	164	17	75	56	2,550	1,904	27.1			57.2	42.8	74.1	29.9		6
Selection No. 177	158	161	21	60	55	2,040	1,870	26.7			52.1	47.9	81.8	18.2		7
Southern Beauty	158	155	21	57	54	1,938	1,836	26.2			51.3	48.7	79.6	20.4		8
Goodman's Prolific	158	182	39	60	53	2,040	1,802	25.7			53.0	46.0	81.1	18.9		9
Weekley's Improved (N. C. Grown)	158	167	27	47	53	1,598	1,002	25.7			47.0	53.0	71.7	28.3		9
Columbia Beauty	158	176	55	53	42	1,802	1,428	24.0			55.7	44.3	88.0	12.0		10
Gerrick's Prolific	158	163	24	65	42	2,210	1,428	24.0			60.7	39.3	79.7	20.3		10
Batts' Four Ear	158	197	58	80	41	2,720	1,394	19.9			66.1	33.9	78.0	21.0		11
Selection No. 170	158	154	44	73	39	2,482	1,326	18.9			65.1	34.9	74.3	25.7		12

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TABLE VI.—COMPILED RESULTS OF VARIETY TEST OF CORN—IREDELL TEST FARM.

Varieties	1909		1910		1911		1912		1913		Average for Five Years	
	Yield of Shelled Corn in Bushels Per Acre	Rank According to Yield of Shelled Corn in Test of this Year	Yield of Shelled Corn in Bushels Per Acre	Rank According to Yield of Shelled Corn in Test of this Year	Yield of Shelled Corn in Bushels Per Acre	Rank According to Yield of Shelled Corn in Test of this Year	Yield of Shelled Corn in Bushels Per Acre	Rank According to Yield of Shelled Corn in Test of this Year	Yield of Shelled Corn in Bushels Per Acre	Rank According to Yield of Shelled Corn in Test of this Year	Average Yield of Shelled Corn Per Acre	Rank According to Average Yield
Weekley's Improved	26.5	14	38.4	2	39.9	1	34.3	15	66.7	1	40.9	1
Southern Beauty	30.4	5	39.4	1	38.3	2	38.2	9	57.6	3	40.7	2
Parker's Prolific	34.2	1	35.2	6	34.0	9	41.4	4	42.7	13	37.5	3
Bigg's Seven Ear	26.0	17	29.5	16	32.4	16	45.0	1	48.8	6	36.3	4
Boone County	31.0	3	32.8	8	35.1	7	40.3	5	23.3	24	32.5	5
Hickory King	21.5	30	32.1	9	34.6	8	36.2	11	36.4	18	32.1	6
Goodman's Prolific	24.2	22	31.7	11	31.8	18	38.0	10	32.6	21	31.6	7

TABLE VII.—COMPILED RESULTS OF VARIETY TEST OF CORN—EDGECOMBE TEST FARM.

Biggs' Seven Ear	41.5	1	31.9	2	26.5	3	21.1	1	31.1	19	30.4	1
Weekley's Improved	40.7	2	23.3	15	20.6	17	19.4	11	44.9	2	29.7	2
Goodman's Prolific	31.5	10	23.6	13	26.3	4	22.0	6	38.2	11	28.3	3
Hickory King	30.0	13	35.5	1	24.3	8	19.1	12	25.0	23	26.7	4
Parker's Prolific	15.6	31	26.0	8	23.4	10	25.0	2	43.1	5	26.6	5
Southern Beauty	27.2	21	31.3	3	27.6	2	15.0	21	22.5	27	24.9	6
Boone County	13.7	32	25.1	10	21.4	16	16.2	18	23.4	26	19.9	7

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VARIETIES OF CORN AND SOURCES OF SEED SEASON OF 1913.

Variety	*Sources of Seed*
1. Biggs' Seven Ear	Noah Biggs, Scotland Neck, N. C.
2. Gerrick's Prolific	Bureau of Plant Industry, Washington, D. C.
3. Cross No. 182	Bureau of Plant Industry, Washington, C. D.
4. Cross No. 177	Bureau of Plant Industry, Washington, D. C.
5. Cross No. 176	Bureau of Plant Industry, Washington, D. C.
6. Selection No. 164	Bureau of Plant Industry, Washington, D. C.
7. Selection No. 170	Bureau of Plant Industry, Washington, D. C.
8. Parker's Prolific	T. B. Parker, Raleigh, N. C.
9. Southern Beauty	L. A. Stroupe, Tobaccoville, N. C.
10. Goodman's Prolific	J. K. Goodman, Mt. Ulla, N. C.
11. Hickory King	A. O. Lee, Hickory, Va.
12. Columbia Beauty	T. W. Wood & Sons, Richmond, Va.
13. Batts' Four Ear (Ga.)	W. T. Broome, McBean, Ga.
14. Weekley's Improved (Native) Selection No. 35	Iredell Test Farm, Statesville, N. C.
15. Cocke's Prolific	Edgecombe Test Farm, Rocky Mount, N. C.
16. Weekley's Imroved (S. C.)	J. F. Weekley, Ulmers, S. C.
17. E–1–Corn	Coker & Company, Hartsville, S. C.
18. Marlboro Prolific	R. T. Malone, Capleville, Tenn.
19. Eureka	T. W. Wood & Sons, Richmond, Va.
20. Summerour	D. A. Summerour, Marietta, Ga.
21. Boone County	T. W. Wood & Sons, Richmond Va.
22. Blount's Prolific	T. W. Wood & Sons, Richmond, Va.
23. Jarvis' Golden Prolific	J. M. Jarvis, Winston-Salem, N. C.
24. Latham's Double	F. P. Latham, Belhaven, N. C.
25. Craig's Red Cob Prolific	W. R. Craig, Sanford, N. C.
26. Simpkins' Prolific	Summerset Farm Co., Creswell, N. C.
27. E–1XE–5 Bybred Corn	Coker & Company, Hartsville, S. C.
28. Deaton's Favorite	Chas. Deaton, Carthage, N. C.
29. Crook's Prolific Corn	Crook Bros., Huron, Tenn.
30. Raleigh Prolific	S. J. Betts, Raleigh, N. C.
31. Batts' Four Ear (N. C.)	J. F. Batts, Garner, N. C.
32. Shenandoah White Dent	T. W. Wood & Sons, Richmond Va.
33. White Majestic	T. W. Wood & Sons, Richmond, Va.
34. Improved Southern Snow Flake	T. W. Wood & Sons, Richmond, Va.
35. Brook's Pride	Bureau of Plant Industry, Washington, D. C.
36. Rogers' White Dent	Bureau of Plant Industry, Washington, D. C.
37. Chappel	Bureau of Plant Industry, Washington, D. C.
38. Selection No. 181	Bureau of Plant Industry, Washington, D. C.
39. Selection No. 138	Bureau of Plant Industry, Washington, D. C.
40. Selection No. 120	Bureau of Plant Industry, Washington, D. C.
41. Farley Yellow Dent	Bureau of Plant Industry, Washington, D. C.
42. Smith's Yellow Dent (Winona Farm)	J. C. McClung, Kyle, Ohio
43. Whitson	C. P. Whitson, Swannanoa, N. C.

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THE BULLETIN

OF THE

NORTH CAROLINA

DEPARTMENT OF AGRICULTURE

RALEIGH

Vol. 35, No. 4. APRIL, 1914 Whole No. 195

Fertilizer Experiments with Cotton on the Sandy Loam Soils (Norfolk Sandy Loams) of the Coastal Plain

PUBLISHED MONTHLY AND SENT FREE TO CITIZENS ON APPLICATION.

Entered at the Postoffice at Raleigh, N. C., as second class matter, February 7, 1901, under Act of June 6, 1900.

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LETTER OF TRANSMITTAL

Hon. W. A. Graham,
Commissioner of Agriculture.

Sir:—I submit in manuscript a report covering experiments with cotton on the Edgecombe Test Farm for the years 1903-'09, inclusive, together with a discussion of the results. B. W. Kilgore and C. B. Williams are responsible for the plans and conduct of the work in 1903-'07; B. W. Kilgore and G. M. MacNider, 1907-'09. R. W. Pou and R. W. Scott, Jr., had charge of the culture and handling of the crop and E. L. Worthen and W. C. Etheridge did the main work in putting the results in tabular form. C. B. Williams is responsible for the conclusions and the writing of it.

I recommend the publication of this report as the April Bulletin.

Very respectfully,

C. B. Williams,
Chief, Division of Agronomy.

Approved for printing:
W. A. Graham,
Commissioner.

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FERTILIZER EXPERIMENTS WITH COTTON ON THE SANDY LOAM SOILS (NORFOLK SANDY LOAMS) OF THE COASTAL PLAIN

Being a Report of Work with Cotton on the Edgecombe Test Farm in 1903-1909, Inclusive

By B. W. Kilgore, C. B. Williams, G. M. MacNider, and R. W. Scott, Jr.

GENERAL SUMMARY OF RESULTS OF FERTILIZER TESTS

1. The proper fertilization of cotton pays large profits, larger ones than any other staple crop generally grown in the State. What this fertilization should be on these and similar soils is shown by the results of our experiments as given on the following pages.

2. In the production of cotton on this land with only two constituents used nitrogen combined with potash afforded the largest net returns per acre, while a mixture of nitrogen and phosphoric acid gave the smallest profit. The use of phospphoric acid and potash averaged $4.06 more profit per acre than phosphoric acid and nitrogen, but it was not so great by $6.24 per acre as that secured on an average by the use of a mixture carrying nitrogen and potash.

The experiments as a whole show nitrogen to be the dominant or controlling constituent of plant-food for increasing yields and adding the greatest profit per acre in growing cotton on this type of soil.

3. The results show that lime alone has been used on an average at a small profit. In combination with nitrogen, phosphoric acid and potash to make a complete fertilizer it has shown an annual increased profit of $6.17 per acre above the net returns secured from the use of the complete fertilizer alone.

The results show that for cotton growing on this type of land the use of moderate quantities of lime particularly in connection with a complete fertilizer will prove quite profitable.

4. The amount of nitrogen used in the normal fertilizer (400 pounds per acre), applied in these cotton experiments, was 2½ per cent, or 10 pounds to the acre. This amount was varied so as to give 5, 10, 20 and 30 pounds of nitrogen per acre. The yields and profits per acre were increased as the applications of nitrogen were made larger. As an average of all the results on the two fields, both increase in the yield due to fertilizer and in profit per acre were almost tripled by the use of 30 pounds of nitrogen with normal amounts of phosphoric acid and potash over what they were where only 5 pounds of nitrogen was used with normal amounts of phosphoric acid and potash. The former application on an average gave a profit of $26.45 per acre over cost of fertilizer applied. The increase of 25 pounds of nitrogen in the formula

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(from $N\frac{1}{2}PK$ to N_3PK) has resulted in returns on an average equivalent to 69 cents for each pound of nitrogen added between 5 and 30 pounds per acre. The use of 30 pounds of nitrogen, with the exception of the two and one-half times normal fertilizer application, was the most profitable one tried. Five pounds of nitrogen would be supplied by 81 pounds of 7½ per cent cottonseed meal, by 40 pounds of 15 per cent dried blood or by 34 pounds of 18 per cent nitrate of soda.

5. The amount of phosphoric acid in the normal fertilizer (400 pounds per acre) was 7 per cent which is equivalent to 28 pounds per acre. This quantity was varied so as to apply 14, 28, 56 and 84 pounds respectively of phosphoric acid per acre, with normal amounts of nitrogen and potash. These amounts of phosphoric acid would be supplied by 100, 200, 400 and 600 pounds respectively of 14 per cent acid phosphate. The greatest net returns over cost of fertilizer per acre was secured in the study of the most profitable quantity of phosphoric acid to use on cotton, by the use of 28 pounds per acre.

6. The amount of potash in the normal fertilizer (400 pounds per acre) was 2½ per cent, equivalent to 10 pounds per acre. Varying this amount so as to apply 5, 10, 20 and 30 pounds per acre respectively, the results indicate (with one apparently abnormal exception) that the largest profit over cost of fertilizer from different quantities of potash was obtained from the use of about 20 pounds of potash with normal amounts of nitrogen and phosphoric acid. To supply 20 pounds per acre of potash will require an application of 167 pounds of 12 per cent kainit, 100 pounds of 20 per cent manure salt, or 40 pounds of 50 per cent muriate or sulphate of potash.

7. Varying the amounts of the normal fertilizer applications from 200 to 1,000 pounds per acre gave progressively increased yields and profits as the quantity of fertilizer was made larger, the results being quite uniform on an average in this regard. The averages, after deducting for cost of fertilizer showed the following net profits:

200 pounds of fertilizer per acre gave a profit of	$ 5.95.
400 pounds of fertilizer per acre gave a profit of	11.45.
600 pounds of fertilizer per acre gave a profit of	23.70.
800 pounds of fertilizer per acre gave a profit of	31.63.
1,000 pounds of fertilizer per acre gave a profit of	34.47.

Putting this in a slightly different way, on an average the first 200 pounds of fertilizer yielded a net profit (after deducting for the cost of fertilizer) of $2.98 for each 100 pounds of fertilizer; the application of 400 pounds yielded $2.86 per 100 pounds; 600 pounds yielded $3.95 per 100 pounds; 800 pounds yielded $3.95 per 100 pounds; and 1,000 pounds yielded $3.45 profit per 100 pounds of fertilizer.

8. Comparisons of dried blood and nitrate of soda as sources of nitrogen showed no great advantage one over the other in the production of cotton on this type of soil. In the tests nitrate of soda was applied one-half at planting and one-half about July 1, on one plat; one-half was applied about July 1, the other half of the nitrogen coming from dried blood, which was applied before planting on another plat, and

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on a third plat nitrate of soda furnished one-fifth of the nitrogen, the balance coming from dried blood, all being applied before planting. The blood was applied one-half at planting and one-half about July 1, on one plat; one-half at planting, the rest of the nitrogen coming from nitrate of soda which was applied July 1 on another plat, and on a third plat four-fifths of the nitrogen was supplied by blood and one-fifth by nitrate of soda. The most economical method of application and the one which made the highest yield of seed cotton was the one which received half of the nitrogen as dried blood in the row at planting with normal quantities of phosphoric acid and potash and the remaining half of the nitrogen as a side dressing in the form of nitrate of soda about July 1.

9. Where 400 pounds of fertilizer were applied each in the drill before planting, broadcast before planting, and divided into two equal parts, one-half being applied in the drill before planting and the other half as a side dressing about July 1, the results are not uniform, but on an average seem to indicate best returns from applying one-half of the fertilizer in drill at planting and other half alongside the row about July 1.

10. Where only 400 pounds is used to the acre the best and most economical returns will be in the drill or alongside the row rather than to be applied broadcast.

11. Our analyses of the various soils of the State indicate that these results will apply to the sandy and fine sandy (Norfolk) loams of the upper Coastal Plain section of the State.

12. In the production of cotton on these soils, taking the results here reported as a whole, it is recommended that at least 400 pounds of fertilizer be used and as much more as can be afforded up to 1,000 pounds per acre. The fertilizer can be most profitably applied in the drill before planting; one-half at planting and the other half as a side dressing about July 1; one-half of the nitrogen as blood, cottonseed meal, fish scrap or tankage in the row at planting with all the phosphoric acid and potash and the remaining nitrogen as nitrate of soda as a side dressing about July 1; or all of the nitrogen in some of the recognized organic forms of carriers of nitrogen with the phosphoric acid and potash at planting.

On land deficient in humus or where no considerable leguminous crops or residues have recently been plowed into the soil, the fertilizer constituents should be contained in the mixture in about the proportion of 7 per cent phosphoric acid, 7 per cent of nitrogen, and 5 per cent of potash. The nitrogen may be all derived from blood, tankage, cottonseed meal, or similar products, or in part from one or all of these, and in part (up to one-half) from nitrate of soda.

Kainit, manure salt, sulphate or muriate of potash may furnish the potash, and acid phosphate the phosphoric acid.

Four hundred pounds of the above mixture would contain 28 pounds of available phosphoric acid, 28 pounds of nitrogen and 20 pounds of potash, and 1,000 pounds would contain 70 pounds of available phosphoric acid, 70 pounds of nitrogen, and 50 pounds of potash. The required amounts of phosphoric acid in 400 and 1,000 pounds respect-

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ively of this mixture would be supplied by 175 pounds and 438 pounds of 16 per cent acid phosphate; the nitrogen by 215 pounds and 538 pounds of 13 per cent (N.) dried blood; and the potash by 100 pounds and 250 pounds of manure salt. Other materials or other grades of these same materials may be used, and it will not be difficult, knowing just what they contain, to use such quantities of them as will be necessary to furnish the quantities of plant food, having in mind that it is the specific number of pounds of phosphoric acid, nitrogen and potash that is desired, rather than a given weight of mixed fertilizer.

13. On a whole the results show that lime used at the rate of 1,000 pounds of slaked lime broadcast every two or four years has proven profitable in cotton growing, when the lime was used in connection with an application of the normal fertilizer.

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I. FERTILIZER EXPERIMENTS WITH COTTON ON THE SANDY LOAM SOILS OF THE COASTAL PLAIN

This is the fourth of a series of Bulletins giving the results of experiments to determine the fertilizer or plant food needs of different soil types of the State. The three previous reports issued as the June, August and September (1910) Bulletins of this Department, gave—

1. Results of Fertilizer and Variety Experiments with Cow Peas on Piedmont Red Clay Loam Soil (June).
2. Results of Fertilizer Experiments with Cotton on Piedmont Red Clay Loam Soil; and Varieties, Culture and Fertilization of Cotton on Piedmont Red Clay Loam, Red Clay and Valley Soils (August).
3. Results of Fertilizer Experiments with Corn on Piedmont Red Clay Loam; and Variety Culture and Fertilization of Corn on Piedmont Red Clay Loam, Red Clay, and Valley Soils (September).

More attention is now being paid to the production of cotton than ever before in the history of the State and fertilizers are used more generally and in larger amounts on this crop than in former years.

WORK REPORTED.

Cotton is our leading money crop. More commercial fertilizer is used in fertilizing and growing this crop than any other. It responds readily and profitably to proper fertilization. Some ten years ago systematic experiments were begun to determine the fertilizer or plant-food requirements for the most economical production of cotton on our different cotton soils.

On the following pages are recorded the results of seven years' fertilizer and variety tests of cotton on the Edgecombe Test Farm of this Department, extending through the years 1903-1909 inclusive. The work is being continued to collect further data, when cotton is grown as it has been in the work here recorded, as well as in rotations with other staple crops and soil-improving crops.

LOCATION OF FARM AND CHARACTER OF SOIL.

The Edgecombe Test Farm is located near the center of Edgecombe County, on the main road between Tarboro and Rocky Mount, approximately eight miles from either place. It is two miles south of Kingsboro Station.

The main upland soil of this farm is representative of much of the Coastal Plain Section of the State. It consists of a dark gray sandy to fine sandy loam, eight to twelve inches deep, underlain by a yellow sandy clay subsoil. The surface soil is light in texture, and is commonly very deficient in organic matter. It classifies as Norfolk sandy to fine sandy loam. Like most of the sandy soil of the Coastal Plain, the sand content is mostly silica (quartz sand) which contains no important plant food. The chemical analysis of this type of land shows it to be universally deficient in nitrogen and phosphoric acid, and in

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the southeastern part of the State, also in potash. The potash content is much higher in the northern part of the Coastal Plain Section; especially is this true northeast of Albemarle Sound. The soil of the Edgecombe Test Farm is between these two extremes, approaching the low rather than the high potash content. Consequently we could hardly expect the increase from the use of potash to be as great when used on this character of soil in the counties to the north of Edgecombe, but in those to the south its use should be accompanied with larger increases and greater profit. These light sandy soils are also deficient in lime. This deficiency is noticeable in the growing of legume crops. Bacteriological investigations show this soil to be very deficient in beneficial bacterial life.

The following figures which are averages for several samples taken on the Edgecombe Farm show the chemical composition of the soil. They state the pounds of plant food per acre contained in the surface to the depth of six and two-third inches, and in subsoil to the depth of twenty-eight inches.

	Pounds in Surface. 6⅔ inches.	*Pounds in Subsoil. 28 inches.*
Nitrogen (N)	984	1,720
Phosphoric Acid (P_2O_5)	1,236	2,200
Potash (K_2O)	3,810	13,200
Lime (CaO)	3,595	10,216

PLATS.

The plats on which the experiments were conducted were embraced in fields A and B. The farm on which all the plats are located has been in cultivation for a good many years. The experiments were started on field A in 1903 and on field B in 1905. The plats in field A were laid off in three parallel series of thirteen plats each with a turn row or driveway between each series. The plats are one-tenth acre in size or 217.8 feet by 20 feet, with an unfertilized space between plats sufficient for one row and a four-foot unfertilized space at the end of rows. Plats 1, 2, and 3 of the second series, and 1, 2, 3, 4, 5, 6, 7, and 8 of the third series of this field are somewhat inferior in fertility naturally to the other plats of the field, due to surface washing.

The plats in field B were laid out in a similar way to those of field A, except that the plats in the third series were of one-twentieth acre size, but in the other two series they were of the same dimensions as those of field A. Another difference was that in field B provision was made for two rows between plats instead of one as in field A and these extra rows were fertilized like the plat nearest to them, but were not harvested and weighed with the plats. Work was started on field B in 1905 and a rotation of cotton and corn with field A was begun. Bur clover was sown on field B at the last cultivation of corn in 1908 and of cotton in 1909, but as the bur clover failed in 1909 the plats were seeded to crimson clover early in November and covered by a Planet, Jr., cultivator, going once to the row.

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Field A.—The plats were used for fertilizer experiments with cotton in 1903-'04-'06-'08; and fertilizer experiments with corn in 1905-'07-'09. In case of each of the two crops the same plan or system of fertilization was followed. By this is meant that plat 8 in all cases received only nitrogen and potash, plat 9 only phosphoric acid and potash, plat 10 a normal application of potash, nitrogen, and phosphoric acid, and so on, though the quantities actually applied varied with the two crops. The fertilization of the cotton plats was based on a normal application of 400 pounds per acre of a mixture containing 7 per cent available phosphoric acid and 2½ per cent each of nitrogen and potash. The fertilization for corn was on a basis of 300 pounds per acre of a mixture containing 7 per cent available phosphoric acid, 3 per cent nitrogen, and 1½ per cent potash.

Field B.—These plats were used for fertilizer experiments with corn in 1906 and 1908 and for fertilizer experiments with cotton in 1905-'07-'09.

PREPARATION AND CULTIVATION.

The land in all cases was well prepared by breaking with a two-horse turning plow in the winter, usually January and February, to a depth of 8 to 10 inches, and allowed to remain this way until just before planting, when it was cut up thoroughly with a disk harrow. The rows were run off 3⅓ feet apart, the fertilizer distributed in the drill and covered to a slight ridge, usually with one furrow of disk or other cultivator. This was done some time prior to planting, so as to give the ground time to settle before planting. Russell's Big Boll was the variety of cotton used in all the experiments. The cotton was planted as soon as the weather would permit in the spring, on the slight ridge made in covering the fertilizer, but which was usually brought to a level, or almost to a level, by the cotton planter. The cotton was well cultivated with weeders, harrows, single and two-horse cultivators, requiring not exceeding two furrows to row, making the cultivation deep at beginning and shallow toward the close of the season, when root development of the plants was well extended into the soil. The cultivation was repeated each ten days to two weeks during the season, the crop being laid by between July 15 and August 1, according to season. The crop was thinned as nearly as possible to one stalk in the hill every 15 inches.

FERTILIZATION AND FERTILIZER MATERIALS USED.

As already stated, the fertilizer was applied in the drill just before planting the cotton, the exact quantity of material for each row being weighed out separately so that each row would get its proper amount of the several fertilizer constituents. Acid phosphate was used as the source of phosphoric acid; dried blood as the source of nitrogen, except where there was a comparison of different nitrogen-furnishing materials, or where nitrate of soda was used as a part of the nitrogen; manure salt as the source of potash; and rock or builder's lime for lime. The fertilizer materials were analyzed each year and applications made on the basis of actual analyses, so as to give the exact quantities of nitrogen, phosphoric acid, and potash required for each plat. For the sake of simplicity and convenience in presenting the results of a number of

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years' experiments, the fertilizer applications are expressed in terms of acid phosphate, containing 14 per cent available phosphoric acid, dried blood containing 13 per cent nitrogen, nitrate of soda containing 14.8 per cent nitrogen, and manure salt containing 20 per cent potash, which figures represent the average composition of these materials. The fertilizer applications in the fertilizer experiments are on the basis of 400 pounds per acre for the normal plat (N P K) of a mixture containing 7 per cent available phosphoric acid and 2½ per cent each of nitrogen and of potash. Lime is applied at the rate of 500 pounds of rock, builder's or burnt lime. The fertilizer applications in the tables, in addition to being represented in terms of acid phosphate, dried blood, nitrate of soda, and manure salt, are also expressed in terms of the symbols, N, P, K, and L, which have the following significance:

N equals nitrogen at the rate of 10 pounds per acre, or 77 pounds of 13 per cent dried blood;
P equals phosphoric acid at the rate of 28 pounds per acre, or 200 pounds of 14 per cent acid phosphate;
K equals potash at the rate of 10 pounds per acre, or 50 pounds of 20 per cent manure salt;
L equals lime at the rate of 500 pounds rock or unslaked lime per acre.

There are columns in the tables showing the exact weights in pounds of phosphoric acid, nitrogen, and potash applied to each plat (expressed on acre basis), which will enable any one to use the same amounts of fertilizer constituents in other materials if desired.

The following average prices which fairly represent the cost of the several materials to the farmer for the period under experimentation have been assumed for the materials used:

14 per cent Acid Phosphate	$14.00 per ton.
13 per cent Dried Blood	60.00 per ton.
14.8 per cent Nitrate of Soda (18 per cent Ammonia)	50.00 per ton.
20 per cent Manure Salt	20.00 per ton.
Rock Lime	10.00 per ton.

The arrangements of the plats and the scheme of fertilizer application is shown by the following:

Normal fertilizer application, 400 pounds per acre of a mixture containing—

Phosphoric Acid	7 per cent.
Nitrogen	2½ per cent.
Potash	2½ per cent.

In this normal application—

N equals 10 pounds nitrogen, equals 77 pounds 13 per cent dried blood;
P equals 28 pounds phosphoric acid, equals 200 pounds 14 per cent acid phosphate;
K equals 10 pounds potash, equals 50 pounds 20 per cent manure salt.

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SIZE OF PLATS, ONE-TENTH ACRE.

(217.8 x 20 feet.)

	Application.
First Series—	
8	N K
9	P K
10	N P
11	N P K
12	N½ P K
13	O
14	N_2 P K
15	N_3 P K
16	N P½K
17	N P_2 K
18	N P_3 K
Second Series—	
1^2	N P K½
2^2	N P K_2
3^2	N P K_3
4^2	½ (NPK)
5^2	O
6^2	1½(NPK)
7^2	2 (NPK)
8^2	3 (NPK)
9^2	N P K
10^2	N P K
11^2	N P K
12^2	N P K
13^2	O
Third Series—	
1^3	O
4^3	N P K
5^3	Lime
6^3	N P K L
7^3	N P K

The above represents the plats in field B. In field A and in "Old Field" they are arranged in a similar way.

WEATHER CONDITIONS DURING 1900-'09, INCLUSIVE.

Besides soil, seed, fertilization, and cultivation, and time of planting, weather conditions, mainly the rainfall, influence the crop yield. In the table presented herewith will be found the monthly and annual rainfall during the years covered by the experiments, the mean monthly and annual rainfall since 1868, and the same data for the months of May to September, inclusive. During the growing months the rainfall was

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below normal in all years except 1909. In the years 1903-'04 and '06 this average was approximately an inch or more per month, but for the other three years, 1905-'07 and '08 the deficiency of rainfall during the growing season was only slight. The year 1905 was the only one in the period which had a total rainfall below normal.

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TABLE A.—RAINFALL IN INCHES AT TARBORO.

	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	Means of Observation Since 1868
January	4.41	1.85	2.85	3.38	3.21	3.21	3.29	1.01	5.20	2.00	3.89
February	5.35	1.92	7.23	6.27	4.24	6.79	4.96	4.84	4.38	3.41	4.15
March	2.70	3.02	2.86	5.48	4.09	3.51	5.16	2.85	4.47	1.96	3.92
April	3.34	5.45	2.48	4.39	1.17	7.52	.71	4.60	2.03	5.93	3.20
May	2.07	5.54	4.83	2.43	2.04	4.46	2.17	3.83	4.31	6.17	4.89
June	3.54	1.29	3.08	5.26	2.13	3.66	3.04	5.59	3.27	9.92	4.25
July	2.02	8.24	1.12	4.44	4.87	7.83	6.53	5.20	9.36	4.07	6.35
August	6.72	11.61	5.86	7.43	5.28	4.66	6.09	6.96	6.74	6.99	6.73
September	1.05	8.24	4.16	1.42	2.70	3.00	2.45	3.27	.72	.86	3.47
October	1.06	3.51	3.17	4.81	1.91	1.62	2.87	1.33	3.55	1.42	3.59
November	3.70	1.23	3.35	.74	4.55	.80	.70	5.08	1.25	1.21	2.55
December	3.21	5.11	2.18	2.42	4.48	5.54	3.03	5.05	3.46	2.48	3.75
Annual	39.17	57.01	43.17	48.47	40.67	52.60	41.00	49.61	48.74	46.42	50.77
Monthly average from May to September inclusive	3.08	6.96	3.81	4.15	3.40	4.70	4.06	4.97	4.86	5.60	5.14

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RESULTS.

In studying the yields of the two fields it will be well to bear in mind that on fields A and B the rotation consisted of cotton and corn and that bur clover as a cover crop was not put on fields A and B until latter part of July in 1908. Field B was sown in bur clover in fall of 1909, but as this failed crimson clover was seeded uniformly over the plates early in November.

In the future, as during the past four years (1910-1913) the crops will be grown according to the following rotation:

First year .....Cotton and Crimson Clover.
Second year .....Peanuts and Bur Clover.
Third year .....Corn and Cowpeas.

The cotton, peanut, and corn crops will be fertilized according to the general scheme of conducting the fertilizer experiments.

The experiments were planned to cover the culture and fertilization of cotton as a whole, but the results of the several subdivisions or phases of the subject are grouped in short tables to facilitate examination and the drawing of conclusions, after which they will be considered as a whole and general conclusions drawn for the fertilization of the crop on this type of soil.

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TABLE I—RESULTS OF FERTILIZER EXPERIMENTS WITH COTTON; EFFECT OF NITROGEN, PHOSPHORIC ACID AND POTASH IN DIFFERENT COMBINATIONS; LIME ALONE; AND LIME IN ADDITION TO A COMPLETE FERTILIZER.

RESULTS IN FIELD A IN 1903, 1904, 1905, AND 1908.

Number of Plat	Fertilizer Application Per Acre	Pounds of Nitrogen (N) Per Acre	Pounds of Phosphoric Acid (P_2O_5) Per Acre	Pounds of Potash (K_2O) Per Acre	Yield of Seed Cotton in Pounds Per Acre							Average Annual Yield of Seed Cotton in Pounds Per Acre	Increase in Pounds of Seed Cotton Per Acre Due to Fertiliser	Value of Increase at 4.5 Cents Per Pound	Average Cost of Fertiliser Per Acre	Value of Average Annual Increase Over Cost of Fertiliser
					1903	1904	1905	1906	1907	1908	1909					
7	Unfertilised.....O	.....	.....	.....	1215	1380	.....	900	.....	625	.....	1030	.....	$.....	$.....	$.....
8	77 lbs. 13% blood.....N 50 lbs. 20% manure salt.....K	10	.....	10	1410	1370	.....	1050	.....	1030	.....	1215	185	8.33	2.81	5.52
9	200 lbs. 14% acid phosphate.....P 50 lbs. 20% manure salt.....K	.....	28	10	1245	1185	.....	940	.....	935	.....	1076	46	2.07	1.90	.17
10	77 lbs. 13% blood.....N 200 lbs. 14% acid phosphate.....P 50 lbs. 20% manure salt.....K	10	28	10	1220	1343	.....	1140	.....	1070	.....	1193	163	7.34	4.21	3.13
10[a]	77 lbs. 13% blood.....N 200 lbs. 14% acid phosphate.....P	10	28	.....	1358	1323	.....	990	.....	760	.....	1108	—9	—.41	3.71	—4.12
8[a]	Unfertilised.....O	.....	.....	.....	1248	1328	.....	990	.....	900	.....	1117	.....	.....	.....	.....
6[a]	500 lbs. unslaked lime every 4th year.....L	.....	.....	.....	1245	1240	.....	960	.....	800	.....	1061	—56	—2.52	.63	—3.15
7[a]	77 lbs. 13% blood.....N 200 lbs. 14% acid phosphate.....P 50 lbs. 20% manure salt.....K 500 lbs. unslaked lime every 4th year.....L	10	28	10	1568	1586	.....	1320	.....	1290	.....	1441	324	14.58	4.84	9.74
8[a]	Unfertilised.....O	.....	.....	.....	1248	1328	.....	990	.....	900	.....	1117	.....	.....	.....	.....

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TABLE I—CONTINUED

RESULTS IN FIELD B IN 1905, 1907 AND 1909.

Number of Plat	Fertilizer Application Per Acre	Pounds of Nitrogen (N) Per Acre	Pounds of Phosphoric Acid (P_2O_5) Per Acre	Pounds of Potash (K_2O) Per Acre	Yield of Seed Cotton in Pounds Per Acre							Average Annual Yield of Seed Cotton in Pounds Per Acre	Increase in Pounds of Seed Cotton Per Acre Due to Fertiliser	Value of Increase at 4.5 Cents Per Pound	Average Cost of Fertiliser Per Acre	Value of Average Annual Increase Over Cost of Fertiliser
					1903	1904	1905	1906	1907	1908	1909					
8	77 lbs. 13% blood.....N 50 lbs. 20% manure salt.....K	10		10			1443		1004		730	1059	630	$ 28.35	$ 2.81	$ 25.54
9	200 lbs. 14% acid phosphate.....P 50 lbs. 20% manure salt.....K		28	10			1273		637		710	873	444	19.98	1.90	18.08
10	77 lbs. 13% blood.....N 200 lbs. 14% acid phosphate.....P	10	28				1080		690		380	717	288	12.96	3.71	9.25
11	77 lbs. 13% blood.....N 200 lbs. 14% acid phosphate.....P 50 lbs. 20% manure salt.....K	10	28	10			1455		861		750	1022	593	26.69	4.21	22.48
13	Unfertilised.....O						630		357		300	429				
1[a]	Unfertilised.....O						545		270		60	292				
5[a]	500 lbs. unslaked lime every 4th year.....L						820		600		110	510	218	9.81	.63	9.18
6[a]	77 lbs. 13% blood.....N 200 lbs. 14% acid phosphate.....P 50 lbs. 20% manure salt.....K 500 lbs. unslaked lime every 4th year.....L	10	28	10			1265		996		810	1024	732	32.94	4.84	28.10

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AVERAGE RESULTS FOR SEVEN YEARS IN FIELDS A AND B.

7–13	Unfertilised	O												772				
8–8	77 lbs. 13% blood	N	10											1143	376	16.92	2.81	14.11
	50 lbs. 20% manure salt	K			10													
9–9	200 lbs. 14% acid phosphate	P		28										889	217	9.77	1.90	7.87
	50 lbs. 20% manure salt	K			10													
8^2–13	Unfertilised	O												822				
10^2–10	77 lbs. 13% blood	N	10											989	167	7.52	3.71	3.81
	200 lbs. 14% acid phosphate	P		28														
10–11	77 lbs. 13% blood	N	10											1120	348	15.66	4.21	11.45
	200 lbs. 14% acid phosphate	P		28														
	50 lbs. 20% manure salt	K			10													
8^2–1^3	Unfertilised	O												763				
6^2–5^3	500 lbs. unslaked lime every 4th year	L												825	62	2.79	.63	2.16
7^2–6^3	77 lbs. 13% blood	N	10											1262	499	22.46	4.84	17.62
	200 lbs. 14% acid phosphate	P		28														
	50 lbs. 20% manure salt	K			10													
	500 lbs. unslaked lime every 4th year	L																

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TABLE I—CONTINUED.

RESULTS IN FIELD B IN 1905, 1907 AND 1909.

Number of Plat	Fertilizer Application Per Acre	Pounds of Nitrogen (N) Per Acre	Pounds of Phosphoric Acid (P_2O_5) Per Acre	Pounds of Potash (K_2O) Per Acre	Yield of Seed Cotton in Pounds Per Acre							Average Annual Yield of Seed Cotton in Pounds Per Acre	Increase in Pounds of Seed Cotton Per Acre Due to Fertiliser	Value of Increase at 4.5 Cents Per Pound	Average Cost of Fertiliser Per Acre	Value of Average Annual Increase Over Cost of Fertiliser
					1903	1904	1905	1906	1907	1908	1909					
8	77 lbs. 13% blood.....N 50 lbs. 20% manure salt.....K	10		10			1443		1004		730	1059	630	$ 28.35	$ 2.81	$ 25.54
9	200 lbs. 14% acid phosphate.....P 50 lbs. 20% manure salt.....K		28	10			1273		637		710	873	444	19.98	1.90	18.08
10	77 lbs. 13% blood.....N 200 lbs. 14% acid phosphate.....P	10	28				1080		690		380	717	288	12.96	3.71	9.25
11	77 lbs. 13% blood.....N 200 lbs. 14% acid phosphate.....P 50 lbs. 20% manure salt.....K	10	28	10			1455		861		750	1022	593	26.69	4.21	22.48
13	Unfertilized.....O						630		357		300	429				
1[a]	Unfertilized.....O						545		270		60	292				
5[a]	500 lbs. unslaked lime every 4th year....L						820		600		110	510	218	9.81	.63	9.18
6[a]	77 lbs. 13% blood.....N 200 lbs. 14% acid phosphate.....P 50 lbs. 20% manure salt.....K 500 lbs. unslaked lime every 4th year....L	10	28	10			1265		996		810	1024	732	32.94	4.84	28.10

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AVERAGE RESULTS FOR SEVEN YEARS IN FIELDS A AND B.

7–13	Unfertilised	O											772				
8–8	77 lbs. 13% blood	N	10										1148	376	16.92	2.81	14.11
	50 lbs. 20% manure salt	K			10												
9–9	200 lbs. 14% acid phosphate	P		28									889	217	9.77	1.90	7.87
	50 lbs. 20% manure salt	K			10												
8^2–13	Unfertilised	O											822				
10^2–10	77 lbs. 13% blood	N	10										989	167	7.52	3.71	3.81
	200 lbs. 14% acid phosphate	P		28													
10–11	77 lbs. 13% blood	N	10										1120	348	15.66	4.21	11.45
	200 lbs. 14% acid phosphate	P		28													
	50 lbs. 20% manure salt	K			10												
8^2–1^3	Unfertilised	O											763				
6^2–5^3	500 lbs. unslaked lime every 4th year	L											825	62	2.79	.63	2.16
7^3–6^3	77 lbs. 13% blood	N	10										1262	499	22.46	4.84	17.62
	200 lbs. 14% acid phosphate	P		28													
	50 lbs. 20% manure salt	K			10												
	500 lbs. unslaked lime every 4th year	L															

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EFFECT OF NITROGEN, PHOSPHORIC ACID, POTASH AND LIME ALONE AND IN COMBINATION WITH EACH OTHER ON COTTON YIELDS.

The experiments, the results of which are presented in Table I, were planned to determine the effect on yield of cotton of different fertilizer applications when two of the constituents were applied together, as nitrogen and phosphoric acid (N P), nitrogen and potash (N K), and phosphoric acid and potash (P K), and when all three of the fertilizing constituents were applied to make a complete fertilizer (N P K); also to test the effect of lime (L) when used alone and when used in connection with a complete fertilizer (N P K L). The results are shown in yields of seed cotton per acre for the several years, average yields, average increases over the unfertilized (O) plats which represent the effect of the fertilizer applications, the value of increase, cost of the fertilizer, and value of the average annual increase over cost of fertilizer.

Nitrogen and Phosphoric Acid, N. P. (Plats 10^3 and 10.) Nitrogen and phosphoric acid gave increased yields over the unfertilized plats four of the seven years on the two fields, the annual average increase for the three years in field B being 288 pounds; for four years on field A an average loss of 9 pounds, or an average annual increase for seven years in the two fields of 167 pounds, worth $3.81 over the cost of fertilizer.

Nitrogen and Potash, N K. (Plats 8 and 8.) The application of nitrogen and potash combined gave large increased yields for all years except one. The average increase on field B was 630 pounds per acre, and 185 on field A. The average increase for the seven years was greater than that given by any of the other applications except complete fertilizer and lime. The average profit from this application was $14.11 per acre.

Phosphoric Acid and Potash, P K. (Plats 9 and 9.) Phosphoric acid and potash combined gave a large average annual increase for the three years on field B—444 pounds—but for the four years on field A the average increase was only 46 pounds. This gives an average increase on the two fields of 217 pounds, worth $9.77, which is $7.87 more than the cost of the fertilizer.

Phosphoric Acid, Potash and Nitrogen, N P K. (Plats 10 and 11.) These three materials combined in a complete fertilizer gave average increased yields in both fields. The average annual increase for four years on field A was 163 pounds of seed cotton; and for three years on field B, 593 pounds; or an average increase per acre for the seven years of 348 pounds, worth $11.45 over the cost of fertilizer.

Lime, L. (Plats 6^3 and 5^3.) For the four years on field A the lime plat showed an average annual loss of 56 pounds of seed cotton, representing a financial loss of $3.15. On field B however, this material gave an increase each of the three years, averaging 218 pounds more than the unfertilized plat, and the profit was $9.18. As an average of these two apparently contradictory results lime gave an average increase of 62 pounds, representing a profit of $2.16.

Lime with Complete Fertilizer, N P K L. . (Plats 7^3 and 6^3.) With the exception of the year 1905 on field B, lime in combination with the

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three fertilizer constituents gave a larger yield of cotton than did complete fertilizer without lime. The average yield for the seven years from this treatment was 142 pounds greater than for complete fertilizer without lime. The profit, $17.62, is greater than that from any of the other fertilizer combinations.

Taking the experiments as a whole the average results show that:

The combination of nitrogen and phosphoric acid gave the smallest increase and also the least profit.

That nitrogen and potash gave an average yield of 209 pounds more seed cotton than did the nitrogen and phosphoric acid treatment, with a profit of $14.11.

Phosphoric acid and potash gave a slightly greater yield than nitrogen and phosphoric acid, but not nearly as great as nitrogen and potash.

Nitrogen, added to phosphoric acid and potash, making a complete fertilizer, increased the yield 131 pounds, and gave an additional profit of $3.58.

The results from lime alone, while contradictory on the two fields, show a slight average increase and a profit of $2.16. In addition to complete fertilizer, lime shows an increase of 151 pounds of seed cotton, and its application here was at a profit of $6.17, and for complete application—N P K L—the profit was $17.62.

The main increased yields and profits came from the use of nitrogen and potash. On the whole, practically no great beneficial effect was seen from the phosphoric acid application. The application of lime was in general, accompanied with some profit.

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TABLE II—RESULTS OF FERTILIZER EXPERIMENTS WITH COTTON; EFFECT OF VARYING QUANTITIES OF NITROGEN ON YIELDS.

RESULTS IN FIELD A IN 1903, 1904, 1906 AND 1908.

Number of Plat	FERTILIZER APPLICATION PER ACRE	Pounds of Nitrogen (N) Per Acre	Pounds of Phosphoric Acid (P_2O_5) Per Acre	Pounds of Potash (K_2O) Per Acre	YIELD OF SEED COTTON IN POUNDS PER ACRE							Average Annual Yield of Seed Cotton in Pounds Per Acre	Increase in Pounds of Seed Cotton Per Acre Due to Fertiliser	Value of Increase at 4.5 Cents Per Pound	Average Cost of Fertiliser Per Acre	Value of Average Annual Increase Over Cost of Fertiliser
					1903	1904	1905	1906	1907	1908	1909					
11	38.5 lbs. 13% blood ..... ½ N 200 lbs. 14% acid phosphate..... P 50 lbs. 20% manure salt..... K	5	28	10	1220	1118	.....	1050	.....	1050	.....	1110	80	$3.60	$3.06	$0.54
10	77 lbs. 13% blood..... N 200 lbs. 14% acid phosphate..... P 50 lbs. 20% manure salt..... K	10	28	10	1220	1343	.....	1140	.....	1070	.....	1193	163	7.34	4.21	3.13
12	154 lbs. 13% blood..... 2 N 200 lbs. 14% acid phosphate..... P 50 lbs. 20% manure salt..... K	20	28	10	1723	1666	.....	1110	.....	1480	.....	1495	465	20.93	6.52	14.41
13	231 lbs. 13% blood..... 3 N 200 lbs. 14% acid phosphate..... P 50 lbs. 20% manure salt..... K	30	28	10	2120	1990	.....	1410	.....	1660	.....	1795	765	34.43	8.83	25.60
7	Unfertilised..... O	.....	.....	.....	1215	1380	.....	900	.....	625	.....	1030	.....	.....	.....	.....

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RESULTS IN FIELD B IN 1905, 1907 AND 1909.

12	38.5 lbs. 13% blood ½ N 5 200 lbs. 14% acid phosphate P 28 50 lbs. 20% manure salt K 10	1440	684	740	955	526	23.67	3.06	20.61
11	77 lbs. 13% blood N 10 200 lbs. 14% acid phosphate P 28 50 lbs. 20% manure salt K 10	1455	861	750	1022	593	26.69	4.21	22.48
13	Unfertilized O	630	357	300	429				
14	154 lbs. 13% blood 2 N 20 200 lbs. 14% acid phosphate P 28 50 lbs. 20% manure salt K 10	1558	1085	870	1171	742	33.39	6.52	26.87
15	231 lbs. 13% blood 3 N 30 200 lbs. 14% acid phosphate P 28 50 lbs. 20% manure salt K 10	1755	1186	770	1237	808	36.36	8.83	27.53

AVERAGE RESULTS FOR SEVEN YEARS IN FIELDS A AND B.

7–13	Unfertilized O				772				
11–12	38.5 lbs. 13% blood ½ N 5 200 lbs. 14% acid phosphate P 28 50 lbs. 20% manure salt K 10				1044	272	12.24	3.06	9.18
10–11	77 lbs. 13% blood N 10 200 lbs. 14% acid phosphate P 28 50 lbs. 20% manure salt K 10				1120	348	15.66	4.21	11.45
12–14	154 lbs. 13% blood 2 N 20 200 lbs. 14% acid phosphate P 28 50 lbs. 20% manure salt K 10				1356	584	26.28	6.52	19.76
13–15	231 lbs. 13% blood 3 N 30 200 lbs. 14% acid phosphate P 28 50 lbs. 20% manure salt K 10				1556	784	35.35	8.83	26.45

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EFFECT OF VARYING QUANTITIES OF NITROGEN.

These tests (Table II) were planned to determine the effect on the yield of cotton of varying quantities of nitrogen, leaving the phosphoric acid and potash constant. On one plat the nitrogen was reduced to one-half of the normal quantity, making the application 5 pounds of nitrogen per acre or practically 1¼ per cent in the fertilizer mixture. On two of the plats it was increased by 2 and 3 times the normal quantity (10 pounds per acre), making the application 20 and 30 pounds per acre respectively, or on basis of the fertilizer mixture 5 and 7½ per cent. The average results for both fields show the largest yield and profit from the fertilizer application containing three times normal or the largest quantity of nitrogen in the several mixtures. The three times normal application which represents a fertilizer analyzing 7—7½—2½ gave an average annual increase of 784 pounds of seed cotton, a profit of $26.45 over the cost of fertilizer. With the exception of the two and a half times normal application this represents the largest profit.

These results indicate as they do those with corn, that nitrogen is one of the controlling constituents, if not the most important one for crop production on this soil.

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TABLE III—RESULTS OF FERTILIZER EXPERIMENTS WITH COTTON; EFFECT OF VARYING QUANTITIES OF PHOSPHORIC ACID.

RESULTS IN FIELD A IN 1903, 1904, 1906, AND 1908.

Number of Plat	Fertilizer Application Per Acre	Pounds of Nitrogen (N) Per Acre	Pounds of Phosphoric Acid (P_2O_5) Per Acre	Pounds of Potash (K_2O) Per Acre	Yield of Seed Cotton in Pounds Per Acre							Average Annual Yield of Seed Cotton in Pounds Per Acre	Increase in Pounds of Seed Cotton Per Acre Due to Fertiliser	Value of Increase at 4.5 Cents Per Pound	Average Cost of Fertiliser Per Acre	Value of Average Annual Increase Over Cost of Fertiliser
					1903	1904	1905	1906	1907	1908	1909					
*1[2]	77 lbs. 13% blood.....N 100 lbs. 14% acid phosphate.....½P 50 lbs. 20% manure salt.....K	10	14	10	1020	1045	.....	990	.....	775	.....	958	—57	—$2.57	$3.51	—$6.08
7	Unfertilized.....O	.....	.....	.....	1215	1380	.....	900	.....	625	.....	1030	.....	.....	.....	.....
10	77 lbs. 13% blood.....N 200 lbs. 14% acid phosphate.....P 50 lbs. 20% manure salt.....K	10	28	10	1220	1343	.....	1140	.....	1070	.....	1193	163	7.34	4.21	3.13
*2[2]	77 lbs. 13% blood.....N 400 lbs. 14% acid phosphate.....2 P 50 lbs. 20% manure salt.....K	10	56	10	1070	1079	.....	1180	.....	980	.....	1077	62	2.79	5.61	—2.82
*3[2]	77 lbs. 13% blood.....N 600 lbs. 14% acid phosphate.....3 P 50 lbs. 20% manure salt.....K	10	84	10	1170	1178	.....	1200	.....	955	.....	1126	111	5.00	7.01	—2.01
7[2]	Unfertilized.....O	.....	.....	.....	1268	1158	.....	910	.....	722	.....	1015	.....	.....	.....	.....

*These plats are not as productive naturally as the other plats in the series of Field A. Much of the top soil has been washed off, they being located on the highest portion of the field.

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TABLE III—CONTINUED.

RESULTS IN FIELD B IN 1905, 1907 AND 1909.

Number of Feet	Fertilizer Application Per Acre	Pounds of Nitrogen (N) Per Acre	Pounds of Phosphoric Acid (P_2O_5) Per Acre	Pounds of Potash (K_2O) Per Acre	Yield of Seed Cotton in Pounds Per Acre							Average Annual Yield of Seed Cotton in Pounds Per Acre	Increase in Pounds of Seed Cotton Due to Fertilizer	Value of Increase at 4.5 Cents Per Pound	Cost of Fertilizer Per Acre	Value of Average Annual Increase Over Cost of Fertilizer
					1903	1904	1905	1906	1907	1908	1909					
	77 lbs. 13% blood.....N	10														
16	100 lbs. 14% acid phosphate.....½ P		14				1238		904		680	941	512	$23.04	$3.51	$19.53
	50 lbs. 20% manure salt.....K			10												
	77 lbs. 13% blood.....N	10														
11	200 lbs. 14% acid phosphate.....P		28				1455		861		750	1022	593	26.69	4.21	22.48
	50 lbs. 20% manure salt.....K			10												
	77 lbs. 13% blood.....N	10														
17	400 lbs. 14% acid phosphate.....2 P		56				1378		976		770	1041	612	27.54	5.61	21.93
	50 lbs. 20% manure salt.....K			10												
	77 lb. 13% blood.....N	10														
18	600 lbs. 14% acid phosphate.....3 P		84				1503		973		860	1112	683	30.74	7.01	23.73
	50 lbs. 20% manure salt.....K			10												
13	Unfertilized.....O						630		357		300	429				

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AVERAGE RESULTS FOR SEVEN YEARS IN FIELDS A AND B.

7^2–13	Unfertilised	O			764	$	$	$	
1^2–16	77 lbs. 13% blood	N 10			951	187	8.42	3.51	4.91
	100 lbs. 14% acid phosphate	½ P	14						
	50 lbs. 20% manure salt	K		10					
7–13	Unfertilised	O			772				
10–11	77 lbs. 13% blood	N 10			1120	348	15.66	4.21	11.45
	200 lbs. 14% acid phosphate	P	28						
	50 lbs. 20% manure salt	K		10					
2^2–17	77 lbs. 13% blood	N 10			1062	298	13.41	5.61	7.80
	400 lbs. 14% acid phosphate	2 P	56						
	50 lbs. 20% manure salt	K		10					
3^2–18	77 lbs. 13% blood	N 10			1120	356	16.02	7.01	9.01
	600 lbs. 14% acid phosphate	3 P	84						
	50 lbs. 20% manure salt	K		10					

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EFFECT OF VARYING QUANTITIES OF PHOSPHORIC ACID.

The above experiments (in Table III) were planned to show the effect on the yields of seed cotton of varying quantities of phosphoric acid, the nitrogen and potash remaining the same. On one plat one-half the normal quantity of phosphoric acid was applied, or an amount represented by 100 pounds of 14 per cent acid phosphate and equivalent to 3½ per cent phosphoric acid in the fertilizer mixture. On two plats were applied two and three times the normal quantities of phosphoric acid, represented by 400 and 600 pounds of 14 per cent acid phosphate respectively, or 56 and 84 pounds of phosphoric acid per acre.

Varying the amounts of phosphoric acid had no very marked effect on the yield of cotton. The application of more than normal—28 pounds per acre—which is equal to an application of 200 pounds of 14 per cent acid phosphate failed to increase the yield, and consequently gave less profit. However, when the amount was reduced to one-half normal both yield and profit were less. It is well to remember in this connection that nitrogen and potash alone (see Table I) gave a larger yield and greater profit than did any of the mixtures containing phosphoric acid. These results certainly indicate that the application of phosphoric acid in the form of acid phosphate is not accompanied with much profit.

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TABLE IV—RESULTS OF FERTILIZER EXPERIMENTS WITH COTTON; EFFECT OF VARYING QUANTITIES OF POTASH.

RESULTS IN FIELD A IN 1903, 1904, 1906 AND 1908.

Number of Plat	Fertilizer Application Per Acre	Pounds of Nitrogen (N) Per Acre	Pounds of Phosphoric Acid (P_2O_5) Per Acre	Pounds of Potash (K_2O) Per Acre	Yield of Seed Cotton in Pounds Per Acre							Average Annual Yield of Seed Cotton in Pounds Per Acre	Increase in Pounds of Seed Cotton Per Acre Due to Fertilizer	Value of Increase at 4.5 Cents Per Pound	Average Cost of Fertilizer Per Acre	Value of Average Annual Increase Over Cost of Fertilizer
					1903	1904	1905	1906	1907	1908	1909					
4[2]	77 lbs. 13% blood.....N 200 lbs. 14% acid phosphate.....P 25 lbs. 20% manure salt.....½K	10	28	5	1370	1273	------	1210	------	935	------	1197	182	$ 8.19	$ 3.96	$ 4.23
7	Unfertilised.....O	------	------	------	1215	1380	------	900	------	625	------	1030	------	------	------	------
10	77 lbs. 13% blood .....N 200 lbs. 14% acid phosphate.....P 50 lbs. 20% manure salt.....K	10	28	10	1220	1343	------	1140	------	1070	------	1193	163	7.34	4.21	3.13
5[2]	77 lbs. 13% blood.....N 200 lbs. 14% acid phosphate.....P 100 lbs. 20% manure salt..... 2 K	10	28	20	1393	1337	------	1210	------	1170	------	1278	263	11.84	4.71	7.13
6[2]	77 lbs. 13% blood .....N 200 lbs. 14% acid phosphate .....P 150 lbs. 20% manure salt..... 3 K	10	28	30	1393	1365	------	1170	------	1320	------	1312	297	13.37	5.21	8.16
7[2]	Unfertilised.....O	------	------	------	1268	1158	------	910	------	722	------	1015	------	------	------	------

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TABLE IV—CONTINUED.

RESULTS IN FIELD B IN 1905, 1907 AND 1909.

Number of Plat	Fertilizer Application Per Acre	Pounds of Nitrogen (N) Per Acre	Pounds of Phosphoric Acid (P_2O_5) Per Acre	Pounds of Potash (K_2O) Per Acre	Yield of Seed Cotton in Pounds Per Acre							Average Annual Yield of Seed Cotton in Pounds Per Acre	Increase in Pounds of Seed Cotton Per Acre Due to Fertilizer	Value of Increase at 4.5 Cents Per Pound	Average Cost of Fertilizer Per Acre	Value of Average Annual Increase Over Cost of Fertilizer
					1903	1904	1905	1906	1907	1908	1909					
1[2]	77 lbs. 13% blood ..... N 200 lbs. 14% acid phosphate ..... P 25 lbs. 20% manure salt ..... ½ K	10	28	5			1608		1470		930	1336	966	43.47	3.96	39.15
13	Unfertilised ..... O						630		357		300	429				
11	77 lbs. 13% blood ..... N 200 lbs. 14% acid phosphate ..... P 50 lbs. 20% manure salt ..... K	10	28	10			1455		861		750	1022	593	26.69	4.21	22.48
2[2]	77 lbs. 13% blood ..... N 200 lbs. 14% acid phosphate ..... P 100 lbs. 20% manure salt ..... 2 K	10	28	20			1423		1287		930	1213	843	37.94	4.71	33.23
3[2]	77 lbs. 13% blood ..... N 200 lbs. 14% acid phosphate ..... P 150 lbs. 20% manure salt ..... 3 K	10	28	30			1370		1484		800	1218	848	38.16	5.21	32.95
5[2]	Unfertilised ..... O						520		410		180	370				

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AVERAGE RESULTS FOR SEVEN YEARS IN FIELDS A AND B.

7^2–5^2	Unfertilised	O										739		$	$	$
4^2–1^2	77 lbs. 13% blood	N	10													
	200 lbs. 14% acid phosphate	P		28								1257	518	23.31	3.96	19.35
	25 lbs. 20% manure salt	½ K			5											
7–13	Unfertilised	O										772				
10–11	77 lbs. 13% blood	N	10													
	200 lbs. 14% acid phosphate	P		28								1120	348	15.66	4.21	11.45
	50 lbs. 20% manure salt	K			10											
5^2–2^2	77 lbs. 13% blood	N	10													
	200 lbs. 14% acid phosphate	P		28								1250	511	23.00	4.71	18.29
	100 lbs. 20% manure salt	2 K			20											
6^2–3^2	77 lbs. 13% blood	N	10													
	200 lbs. 14% acid phosphate	P		28								1272	533	23.99	5.21	18.78
	150 lbs. 20% manure salt	3 K			30											

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EFFECT OF VARYING QUANTITIES OF POTASH.

The experiments reported in Table IV were arranged to show the effect on the yield of seed cotton of varying quantites of potash, the nitrogen and phosphoric acid remaining constant. On one plat only one-half the normal quantity of potash was applied, or 1¼ per cent in the fertilizer mixture, or 5 pounds of potash per acre, while on two other plats two and three times the normal quantities were given, or 20 and 30 pounds of actual potash per acre respectively. On basis of the normal fertilizer mixture this would represent 5 and 7½ per cent of potash in the mixture.

The yield of cotton on Plat 1², field B, which received one-half normal potash is abnormally high. With this exception, increased amounts of potash gave increased amounts of cotton on this field. However, the increase on field B from the application of three times normal—30 pounds—over twice normal—20 pounds—was not enough to pay for the additional fertilizer. For the four years' average on field A, increased amounts of potash gave increased yields and small increased profits. In general it appears that with cotton increasing amounts of potash can hardly be expected to much more than pay for themselves.

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TABLE V—RESULTS OF FERTILIZER EXPERIMENTS WITH COTTON; EFFECT OF VARYING QUANTITIES OF FERTILIZER ON YIELDS.

RESULTS IN FIELD A IN 1903, 1904, 1906 AND 1908.

Number of Plat	Fertilizer Application Per Acre	Pounds of Nitrogen (N) Per Acre	Pounds of Phosphoric Acid (P_2O_5) Per Acre	Pounds of Potash (K_2O) Per Acre	Yield of Seed Cotton in Pounds Per Acre							Average Annual Yield of Seed Cotton in Pounds Per Acre	Increase in Pounds of Seed Cotton Per Acre Due to Fertilizer	Value of Increase at 4.5 Cents Per Pound	Average Cost of Fertilizer Per Acre	Value of Average Annual Increase Over Cost of Fertilizer
					1903	1904	1905	1906	1907	1908	1909					
8[3]	Unfertilized ..... O				1248	1328	.....	990	.....	900	.....	1117	.....	$.....	$.....	$.....
11[3]	38.5 lbs. 13% blood ..... ½ N 100 lbs. 14% acid phosphate ..... ½ P 25 lbs. 20% manure salt ..... ½ K	5	14	5	1310	1198	.....	950	.....	850	.....	1077	—40	—1.80	—2.11	—3.91
7	Unfertilized ..... O				1215	1380	.....	900	.....	625	.....	1030	.....	.....	.....	.....
10	77 lbs. 13% blood ..... N 200 lbs. 14% acid phosphate ..... P 50 lbs. 20% manure salt ..... K	10	28	10	1220	1343	.....	1140	.....	1070	.....	1193	163	7.34	4.21	3.13
8[3]	115.5 lbs. 13% blood ..... 1½ N 300 lbs. 14% acid phosphate ..... 1½ P 75 lbs. 20% manure salt ..... 1½ K	15	42	15	1418	1413	.....	1330	.....	1290	.....	1363	348	15.66	6.32	9.34
9[3]	154 lbs. 13% blood ..... 2 N 400 lbs. 14% acid phosphate ..... 2 P 100 lbs. 20% manure salt ..... 2 K	20	56	20	1568	1615	.....	1310	.....	1480	.....	1493	478	21.51	8.42	13.09
10[3]	192.5 lbs. 13% blood ..... 2½ N 500 lbs. 14% acid phosphate ..... 2½ P 125 lbs. 20% manure salt ..... 2½ K	25	70	25	1630	1723	.....	1400	.....	1560	.....	1578	563	25.34	10.53	14.81
7[3]	Unfertilized ..... O				1268	1158	.....	910	.....	722	.....	1015	.....	.....	.....	.....

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TABLE V—CONTINUED.

RESULTS IN FIELD B IN 1905, 1907 AND 1909.

Number of Plat	Fertilizer Application Per Acre	Pounds of Nitrogen (N) Per Acre	Pounds of Phosphoric Acid (P_2O_5) Per Acre	Pounds of Potash (K_2O) Per Acre	Yield of Seed Cotton in Pounds Per Acre							Average Annual Yield of Seed Cotton in Pounds Per Acre	Increase in Pounds of Seed Cotton Per Acre Due to Fertilizer	Value of Increase at 4.5 Cents Per Pound	Average Cost of Fertilizer Per Acre	Value of Average Annual Increase Over Cost of Fertilizer
					1903	1904	1905	1906	1907	1908	1909					
4[2]	38.5 lbs. 13% blood—½ N 100 lbs. 14% acid phosphate—½ P 25 lbs. 20% manure salt—½ K	5	14	5			960		1005		560	842	472	$21.24	$2.11	$19.13
5[2]	Unfertilised—O						520		410		180	370				
13	Unfertilised—O						630		357		300	429				
11	77 lbs. 13% blood—N 200 lbs. 14% acid phosphate—P 50 lbs. 20% manure salt—K	10	28	10			1455		861		750	1022	593	26.69	4.21	22.48
5[2]	Unfertilised—O						520		410		180	370				
6[2]	115.5 lbs. 13% blood—1½ N 300 lbs. 14% acid phosphate—1½ P 75 lbs. 20% manure salt—1½ K	15	42	15			1243		1266		785	1098	804	36.18	6.32	29.86
7[2]	154 lbs. 13% blood—2 N 400 lbs. 14% acid phosphate—2 P 100 lbs. 20% manure salt—2 K	20	56	20			1528		1751		1055	1445	1151	51.80	8.42	43.38
8[2]	192.5 lbs. 13% blood—2½ N 500 lbs. 14% acid phosphate—2½ P 125 lbs. 20% manure salt—2½ K	25	70	25			1823		1727		1210	1587	1293	58.19	10.53	47.66
13[2]	Unfertilised—O						410		185		60	218				

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TABLE V—CONTINUED.

AVERAGE RESULTS FOR SEVEN YEARS IN FIELDS A AND B.

8^2–5^2	Unfertilized—O				797		$	$	$
11^2–4^2	38.5 lbs. 13% blood—½ N	5							
	100 lbs. 14% acid phosphate—½ P		14		976	179	8.06	2.11	5.95
	25 lbs. 20% manure salt—½ K			5					
7–13	Unfertilized—O				772				
10–11	77 lbs. 13% blood—N	10							
	200 lbs. 14% acid phosphate—P		28		1120	348	15.66	4.21	11.45
	50 lbs. 20% manure salt—K			10					
8^2–6^2	115.5 lbs. 13% blood—1½ N	15							
	300 lbs. 14% acid phosphate—1½ P		42		1249	667	30.02	6.32	23.70
	75 lbs. 20% manure salt—1½ K			15					
9^2–7^2	154 lbs. 13% blood—2 N	20							
	400 lbs. 14% acid phosphate—2 P		56		1472	890	40.05	8.42	31.63
	100 lbs. 20% manure salt—2 K			20					
10^2–8^2	192.5 lbs. 13% blood—2½ N	25							
	500 lbs. 14% acid phosphate—2½ P		70		1582	1000	45.00	10.53	34.47
	125 lbs. 20% manure salt—2½ K			25					
7^2–(5^2–13^2)	Unfertilized—O				582				

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EFFECT OF VARYING QUANTITIES OF FERTILIZER ON YIELDS.

The experiments in Table V were planned to show the effect of increasing and decreasing the normal (N P K equals 400 pounds of a fertilizer mixture containing 7 per cent phosphoric acid, 2½ per cent potash and 2½ per cent nitrogen) fertilizer application on the yields. The applications were at the rate of 200 pounds per acre (½ N P K); 400 pounds per acre (N P K); 600 pounds per acre (1½ N P K); 800 pounds per acre (2 N P K); and 1,000 pounds per acre (2½ N P K); The results on several fields and the averages of the two fields are quite uniform in showing increased yields and increased profits for the several increases in the amounts of fertilizer, the quantity of fertilizer per acre varying from 200 to 1,000 pounds. The largest yields, as well as the greatest profit, were obtained from the 1,000-pound application. It is possible that the limit of the most profitable fertilization for cotton on this soil has not been reached, and that more than 1,000 pounds per acre would give remunerative returns. It should be remembered, too, in this connection, that the composition of this mixture is not especially adapted to this soil, as shown by results in previous tables. A larger per cent of nitrogen would certainly have increased the yields and very probably the net profit.

In addition to larger profits from heavy fertilization of the right kind, the land is in all probability improving in productiveness and value. Results on these plats and fields in after years will be most valuable in throwing light on this most important phase of the proper fertilization for immediate returns and for the permanent improvement of the soil. This latter phase of farm practice is not given the thought and consideration it should receive by most farmers.

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TABLE VI—RESULTS OF FERTILIZER EXPERIMENTS WITH COTTON; EFFECT OF DIFFERENT MATERIALS FURNISHING NITROGEN AND TIME OF APPLICATION.

RESULTS IN FIELD A IN 1903, 1904, 1906 AND 1908.

Number of Plat	Fertilizer Application Per Acre	Pounds of Nitrogen (N) Per Acre	Pounds of Phosphoric Acid (P_2O_5) Per Acre	Pounds of Potash (K_2O) Per Acre	Yield of Seed Cotton in Pounds Per Acre 1903	1904	1905	1906	1907	1908	1909	Average Annual Yield of Seed Cotton in Pounds Per Acre	Increase in Pounds of Seed Cotton Per Acre Due to Fertiliser	Value of Increase at 4.5 Cents Per Pound	Average Cost of Fertilizer Per Acre	Value of Average Annual Increase Over Cost of Fertiliser
7[a]	Unfertilized.....O				1268	1158		910		722		1015		$	$	$
11[a]	38.5 lbs. 13% blood appld. at pltg....½ N	5			1455	1449		1330		1070		1326	311	14.00	3.90	10.10
	33.8 lbs. 14.8% nit. soda appld July 1..½ N	5														
	200 lbs. 14% acid phosphate.....P		28													
	50 lbs. 20% manure salt.....K			10												
12[a]	33.8 lbs. 14.8% nit. sod. appld. at pltg..½ N	5			1468	1270		1070		1070		1220	205	9.23	3.59	5.64
	33.8 lbs. 14.8 %nit. sod. appld. July 1..½ N	5														
	200 lbs. 14% acid phosphate.....P		28													
	50 lbs. 20% manure salt.....K			10												
13[a]	38.5 lbs. 13% blood appld. at pltg....½ N	5			1598	1543		1440		1070		1413	398	17.91	4.21	13.70
	38.5 lbs. 13% blood appld. July 1....½ N	5														
	200 lbs. 14% acid phosphate.....P		28													
	50 lbs. 20% manure salt.....K			10												
8[a]	Unfertilized.....O				1248	1328		990		900		1117				
*1[a]	61.6 lbs. 13% blood appld. at pltg....4/5 N	8			1055	1063		1080		1057		1064	—53	—2.39	4.14	—6.53
	13.5 lbs. 14.8 nit. sod. appld. at pltg..1/5 N	2														
	200 lbs. 14% acid phosphate.....P		28													
	50 lbs. 20% manure salt.....K			10												

*This plat is not as good naturally as the other plats of the series used in making the comparisons. The top soil has been washed off to a considerable extent, as they are located on the most elevated portion of the field.

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TABLE VI—CONTINUED.

RESULTS IN FIELD B IN 1905, 1907 AND 1909.

Number of Plat	Fertilizer Application Per Acre	Pounds of Nitrogen (N) Per Acre	Pounds of Phosphoric Acid (P_2O_5) Per Acre	Pounds of Potash (K_2O) Per Acre	Yield of Seed Cotton in Pounds Per Acre 1903	1904	1905	1906	1907	1908	1909	Average Annual Yield of Seed Cotton in Pounds Per Acre	Increase in Pounds of Seed Cotton Per Acre Due to Fertilizer	Value of Increase at 4.5 Cents Per Pound	Average Cost of Fertilizer Per Acre	Value of Average Annual Increase Over Cost of Fertilizer
5[2]	Unfertilized.....O						520		410		180	370		$	$	$
9[2]	38.5 lbs. 13% blood appld. at pltg.....½ N	5					1473		1261		960	1231	937	42.17	3.90	38.27
	33.8 lbs. 14.8% nit. sod. appld. July 1..½ N	5														
	200 lbs. 14% acid phosphate.....P		28													
	50 lbs. 20% manure salt.....K			10												
10[2]	33.8 lbs. 14.8% nit. sod. appld. at pltg..½ N	5					1415		1134		890	1146	852	38.34	3.59	34.75
	33.8 lbs. 14.8% nit. sod. appld. July 1..½ N	5														
	200 lbs. 14% acid phosphate.....P		28													
	50 lbs. 20% manure salt.....K			10												
11[2]	38.5 lbs. 13% blood appld. at pltg.....½ N	5					1325		864		630	940	646	29.07	4.21	24.86
	38.5 lbs. 13% blood appld. July 1.....½N	5														
	200 lbs. 14% acid phosphate.....P		28													
	50 lbs. 20% manure salt.....K			10												
12[2]	61.6 lbs. 13% blood appld. at pltg....4/5 N	8					1350		952		680	994	700	31.50	4.14	27.36
	13.5 lbs. 14.8% nit. sod. appld. at pltg.1/5N	2														
	200 lbs. 14% acid phosphate.....P		28													
	50 lbs. 20% manure salt.....K			10												
13[2]	Unfertilized.....O						410		185		60	218				

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TABL VI—CONTINUED.

AVERAGE RESULTS FOR SEVEN YEARS IN FIELDS A AND B.

7^2–(5^2—13^2)	Unfertilized	O				582		$	$	$
11^2–9^2	38.5 lbs. 13% blood appld. at pltg.	½ N	5							
	33.8 lbs. 14.8 %nit. sod. appld. July 1	½ N	2			1285	703	31.64	3.90	27.74
	200 lbs. 14% acid phosphate	P		28						
	50 lbs. 20% manure salt	K			10					
12^2–10^2	33.8 lbs. 14.8% nit. sod. appld. at pltg.	½ N	5							
	33.8 lbs. 14.8% nit. sod. appld. July 1	½ N	5			1188	606	27.27	3.59	23.68
	200 lbs. 14% acid phosphate	P		28						
	50 lbs. 20% manure salt	K			10					
13^2–11^2	38.5 lbs. 13% blood appld. at pltg.	½ N	5							
	38.5 lbs. 13% blood appld. July 1	½ N	5			1210	628	28.26	4.21	24.05
	200 lbs. 14% acid phosphate	P		28						
	50 lbs. 20% manure salt	K			10					
8^2–(5^2—13^2)	Unfertilized	O				623				
1^2–12^2	61.6 lbs. 13% blood appld. at pltg.	4/5 N	8							
	13.2 lbs. 14.8% nit. sod. appld. at pltg.	1/5 N	2			1034	411	18.50	4.14	14.36
	200 lbs. 14% acid phosphate	P		28						
	50 lbs. 20% manure salt	K			10					

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EFFECT OF DIFFERENT MATERIALS FURNISHING NITROGEN AND TIME OF APPLICATION.

The experiments, the results of which are presented in Table VI, were arranged to test the comparative value of dried blood and nitrate of soda as nitrogen-furnishing materials in growing cotton, as well as the best way of applying these.

Nitrate of soda is a material easily soluble in water and therefore quickly available for the use of plants. The questions usually raised in connection with its use are the possibility of its loss from the soil, especially sandy or open, porous soil, because of its easy solubility in water and its giving out before a long-seasoned crop has made its growth, thus leaving it without a supply of nitrogen before the end of the growing season. Its use is most strongly advocated for short-season crops, as in early truck and vegetable growing, and as a top dressing for grain and for corn and cotton after growth is well advanced, or for any crop when seen to be in need of a quickly-acting nitrogen-supplying material.

Dried blood, which is a fair representative of the animal and vegetable materials furnishing nitrogen, as cotton-seed meal, tankage, etc., is not soluble in water and acts more slowly and for a longer time. It must be changed by rotting or decomposing in the soil into nitrates before it can feed the crop, and is thus likely to be effective throughout a reasonable growing season.

It has become a practice in growing many crops to apply only a part of the nitrogen at the time of planting and a portion later, usually as nitrate of soda, so as to keep the crop growing as rapidly as possible. The tests in Table VI were planned with a view of throwing as much light as possible on these questions of nitrogen fertilization. In the experiments all of the phosphoric acid and potash were applied in the drill before planting. On plats 11^2 and 9^2 one-half the nitrogen was supplied as dried blood and was applied with the phosphoric acid and potash before planting, and one-half the nitrogen was supplied as nitrate of soda and applied about July first. In plats 12^2 and 10^2 all of the nitrogen was furnished by nitrate of soda, one-half being applied before planting, with the phosphoric acid and potash and the other half about July first. On plats 13^2 and 11^2 the nitrogen was supplied by dried blood, one-half being applied before planting, with the phosphoric acid and potash and the other half about July first. On plats 1^3 and 12^2 four-fifths of the nitrogen was furnished by dried blood and one-fifth by nitrate of soda and was all applied before planting, along with the phosphoric acid and potash.

It is evident that there is considerable variation in the different years and on the different fields. In studying these results it is only fair to practically disregard plat 1^3, field A, for it is naturally much less fertile than the check plat of the same series—8^3. With this exception the average table shows no marked difference in profit favoring any single method of application. On the average, two applications of nitrogen, one-half at planting and one-half about July 1, gave the largest increase and profit. Considering the results on field B alone, and this probably

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is more accurate than the average (on account of the lack of uniformity in field A), two applications of the nitrogen in all cases gave larger profit than the single application either applied in the drill before planting (plat 11) or broadcasted (plat 7^3). From the data at hand it hardly seems safe to draw any definite conclusions in favor of either method. Taking into consideration the results from similar treatments on the Iredell Test Farm (see August Bulletin, 1910, No. 139), it appears that the dried blood and nitrate of soda are about equally satisfactory sources of nitrogen, the choice between them depending largely on market prices, and that very little extra profit can be expected by making two applications of the nitrogen when the total amount is not over ten pounds per acre. In larger amounts a second application may prove profitable.

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TABLE VII—RESULTS OF FERTILIZER EXPERIMENTS WITH COTTON; EFFECT OF DIFFERENT METHODS AND TIME OF APPLICATION.

RESULTS IN FIELD A IN 1903, 1904, 1906, AND 1908.

Number of Plat	Fertilizer Application Per Acre		Pounds of Nitrogen (N) Per Acre	Pounds of Phosphoric Acid (P_2O_5) Per Acre	Pounds of Potash (K_2O) Per Acre	Yield of Seed Cotton in Pounds Per Acre 1903	1904	1905	1906	1907	1908	1909	Average Annual Yield of Seed Cotton in Pounds Per Acre	Increase in Pounds of Seed Cotton Per Acre Due to Fertilizer	Value of Increase at 4.5 Cents Per Pound	Average Cost of Fertilizer Per Acre	Value of Average Annual Increase Over Cost of Fertilizer
7	Unfertilized	O				1215	1380	.....	900	.....	625	.....	1030	.....	$.....	$.....	$.....
	77 lbs. 13% blood	N	10														
*10	200 lbs. 14% acid phosphate	P		28		1220	1343	.....	1140	.....	1070	.....	1193	163	7.34	4.21	3.13
	50 lbs. 20% manure salt	K			10												
8[2]	Unfertilized	O				1248	1328	.....	990	.....	900	.....	1117	.....	.....	.....	.....
	77 lbs. 13% blood	N	10														
†4[2]	200 lbs. 14% acid phosphate	P		28		1375	1348	.....	1170	.....	1150	.....	1261	144	6.48	4.21	2.27
	50 lbs. 20% manure salt	K			10												
	77 lbs. 13% blood	N	10														
†9[2]	200 lbs. 14% acid phosphate	P		28		1390	1460	.....	1140	.....	1150	.....	1285	168	7.56	4.21	3.35
	50 lbs. 20% manure salt	K			10												

RESULTS IN FIELD B IN 1905, 1907 AND 1909.

13	Unfertilized	O				.....	.....	630	.....	357	.....	300	429	.....	$.....	$.....	$.....
	77 lbs. 13% blood	N	10														
*11	200 lbs. 14% acid phosphate	P		28		.....	.....	1455	.....	861	.....	750	1022	593	26.69	4.21	22.48
	50 lbs. 20% manure salt	K			10												
1[3]	Unfertilized	O				.....	.....	545	.....	270	.....	60	292	.....	.....	.....	.....
	77 lbs. 13% blood	N	10														
†4[3]	200 lbs. 14% acid phosphate	P		28		.....	.....	1470	.....	896	.....	610	992	700	31.50	4.21	27.29
	50 lbs. 20% manure salt	K			10												
	77 lbs. 13% blood	N	10														
†7[3]	200 lbs. 14% acid phosphate	P		28		.....	.....	1170	.....	737	.....	500	802	510	22.95	4.21	18.74
	50 lbs. 20% manure salt	K			10												

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TABLE VII—CONTINUED.

AVERAGE RESULTS FOR SEVEN YEARS IN FIELDS A AND B.

7–13	Unfertilised	O											772		$	$	$
*10–11	77 lbs. 13% blood	N	10										1120	348	15.66	4.21	11.45
	200 lbs. 14% acid phosphate	P		28													
	50 lbs. 20% manure salt	K			10												
8[2]–1[3]	Unfertilised	O											763				
†4[2]–4[3]	77 lbs. 13% blood	N	10										1146	383	17.24	4.21	13.03
	200 lbs. 14% acid phosphate	P		28													
	50 lbs. 20% manure salt	K			10												
‡9[2]–7[3]	77 lbs. 13% blood	N	10										1078	315	14.18	4.21	9.97
	200 lbs. 14% acid phosphate	P		28													
	50 lbs. 20% manure salt	K			10												

*The fertiliser was applied in the drill before planting on this plat.
†Fertiliser on this plat applied one-half in drill before planting and one-half as side dressing about July 1.
‡Fertiliser on this plat applied broadcast before planting.

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EFFECT OF DIFFERENT METHODS AND TIME OF APPLICATION OF FERTILIZER.

The results presented in Table VII were obtained from experiments planned to show the effect on yield of seed cotton from applying—

(*a*) All the fertilizer in the drill before planting;

(*b*) Dividing the fertilizer into two equal parts, applying one-half in the drill before planting and the other half as a side dressing about July first; and

(*c*) From applying all of the fertilizer broadcast before planting, the quantity of fertilizer and the materials entering into it being the same in all three cases.

Taking the results as a whole, the increased yields and profits show that it has made very little difference whether all of the fertilizer was applied in the drill before planting, or whether it was divided into two equal parts and one-half put in the drill before planting and the other half applied as a side dressing about July first, according to season. The double application gave the largest yield and profit, the drill application before planting slightly less, and the broadcast application a still smaller yield and profit. These differences are hardly sufficient to warrant any definite conclusions in favor of one method above another.

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II. VARIETIES, CULTURE AND FERTILIZATION OF COTTON ON SANDY LOAM SOILS OF THE COASTAL PLAIN

Seven years' fertilizer and variety experiments have been conducted on the sandy loam soil of the Edgecombe Test Farm. On a basis of these results and other information which we have, the suggestions below are given for the culture and fertilization of cotton on the sandy and sandy loam soils of the Coastal Plain section, and the varieties of cotton which are best suited to them.

Cotton is not a hard or exhaustive crop on the soil, when the soil and crop are handled with care and intelligence. A bale of cotton (900 pounds of seed and 500 pounds of lint) removes from the soil in round numbers:

30 pounds Nitrogen,
12 pounds Phosphoric Acid, and
13 pound Potash,

worth at present prices of fertilizer ingredients $7.20. Only 48 cents worth of this is carried away in the lint. The seed can be sold for enough to return in commercial fertilizer considerably more plant food than the lint and seed took from the soil. The stalks, leaves, and bolls, which should never be burned or otherwise removed, and 95 per cent of which have come from the air, add vegetable matter or humus to the soil. If the land is liberally fertilized in the right way, well drained and protected from surface washing, it should continue to produce large and profitable crops of cotton from year to year, and with a good rotation and profitable fertilization will increase in fertility and productiveness. None of our other staple crops are as easy on the soil as is cotton when handled in the way indicated above.

Preparation and Cultivation.—The land should be thoroughly and well prepared by breaking in the fall or early spring to a depth of 6 or 8 inches, and the soil may be gradually deepened beyond this for a few inches to advantage. Before planting, cut up well with a disk harrow to get rid of clods and to make a good seedbed, and run off rows 3½ to 4 feet apart, and on very fertile land 4½ feet. As a rule, the fertilizer should be put in the drill before planting and the cotton planted on a level or just above the level, according to the season and drainage condition of the land. Weeders and light harrows may be run across the rows two or three times before and after the cotton is up and before cultivation with cultivators and hoeing begins. When the crop is well up and danger of frost is over, hoe and thin to a stand of 15 to 20 inches in the drill, leaving as nearly as possible one stalk in a place, and giving greater distance in the row and between rows as the productiveness of the land increases. On thin land the rows should be closer together and the cotton closer in rows, as the stalks do not grow very large; but distance should be given both ways as the land increases in productive-

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ness, from whatever cause brought about. Cultivate with good one or two-horse cultivators, which will not require more than two furrows at greatest to the row, every ten days to two weeks and as nearly as possible after rains to keep down grass and weeds and to conserve the supply of moisture. The cultivation should be comparatively deep early in the season, becoming shallow as the crop grows and the root system develops. Ordinarily cultivation should be continued in the Coastal Plain section of the State until July 15, or later.

Varieties.—Up through 1909 sixty-seven varieties of cotton have been tested on the Edgecombe Farm, a number of these running through the entire period. Generally the later maturing varieties of the big boll type have given the largest returns, though now and then, with a short growing season, the small boll, early maturing kinds have stood well. Among the varieties which have done well are:

Medium to Large Bolled Varieties—

Russell's Big Boll.
Culpepper's Improved.
Cleveland's Big Boll.
Cook's Improved.
Brown's No. 1.
Peterkin's Improved.

Small Bolled Varieties—

King's Improved.
Hodge.
Webb.
Broadwell's Double-Jointed.
Sugar Loaf.

The results of variety tests have been published each year and are summarized in the *February* (1909) *Bulletin*. These results can be had for study by any one specially interested in them.

Fertilization.—Analyses of these soils show that they are very low in nitrogen and phosphoric acid and only fairly well supplied with potash and lime. Experiments show that nitrogen is the most needed constituent for the production of cotton, but that profitable results are secured from the use of materials carrying potash and phosphoric acid. The aim of the farmers on the Coastal Plain soils of the State should be to supply as great amount as possible of the nitrogen requirements of his soil by establishing rotations in which leguminous crops come into the rotation at as frequent intervals as practicable. As many of these crops or crop residues should be plowed into the soil as possible to provide as nearly as possible the requisite amount of nitrogen for other crops in the rotation, and also to store the soil with plenty of organic matter in order to maintain the soil in a good physical condition. Where commercial fertilizers are depended upon largely to supply the nitrogen and other plant food constituents, it is not possible, with the present results, to say just definitely what is the best proportion of these three constitu-

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ents for most profitable returns, but it is certain that the fertilizer should carry a much higher percentage of nitrogen than has been used heretofore, if the soil is not well stocked with organic matter, and that the phosphoric acid may be decreased. The indications are that for the average soil of the Coastal Plain a mixture containing about 7 per cent of available phosphoric acid, 7 per cent of nitrogen and 5 per cent of potash will give close to if not the best results. This mixture should be used for best results at the rate of at least 400 pounds per acre, and as much more as one can afford up to 1,000 pounds.

The nitrogen may be all derived from blood, tankage, cotton-seed meal, or similar products, or in part from one or all of these, and in part (up to one-half) from nitrate of soda or sulphate of ammonia.

Kainit, manure salt, sulphate or muriate of potash may furnish the potash, and acid phosphate the phosphoric acid. Four hundred pounds of the above mixture would contain 28 pounds phosphoric acid, 28 pounds of nitrogen and 20 pounds of potash, and 1,000 pounds would contain 70 pounds phosphoric acid, 70 pounds of nitrogen and 50 pounds of potash. The required amounts of phosphoric acid in 400 and 1,000 pounds respectively of this mixture would be supplied by 175 and 438 pounds of 16 per cent acid phosphate; the nitrogen by 215 and 538 pounds of 13 per cent dried blood, and the potash by 100 pounds and 250 pounds of 20 per cent manure salt. Other materials or other grades of these same materials may be used, and it will not be difficult, knowing just what they contain, to use such quantities of them as will be necessary to furnish the required amount of plant food, having in mind that it is the specific number of pounds of phosphoric acid, nitrogen and potash that is desired, rather than a given weight of mixed fertilizer.

It is not more, but perhaps less difficult to calculate the number of pounds of nitrogen, phosphoric acid, and potash to be applied per acre to any given crop from materials which are to be had than to estimate the exact number of pounds of materials to make a formula of a certain composition; as, for example, in an 8-2-2 goods. The question of filler does not have to be considered in doing this, as is necessary in making a fertilizer formula in the usual way. When it is desired, for instance, to apply the equivalent of 400 pounds per acre of a fertilizer mixture containing 7 per cent of available phosphoric acid, 7 per cent of nitrogen and 5 per cent of potash, or 28 pounds of phosphoric acid, 28 pounds of nitrogen, and 20 pounds of potash, it is only necessary to divide the number of pounds of plant food desired per acre (28, 28, and 20) by the percentage composition of the materials to be used, as follows:

Number of Pounds of Plant Food per Acre Wanted		Percentage Composition of the Materials to be Used		Number of Pounds of Fertilizer Materials per Acre to Apply
Phosphoric Acid.....28 Lbs.	+	16% Acid Phosphate.....	=	175 Pounds.
Nitrogen.....28 Lbs.	+	13% Dried Blood.....	=	215 Pounds.
Potash.....20 Lbs.	+	20% Manure Salt.....	=	100 Pounds.

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With cotton planted on the coarse sandy or fine sandy loam soils of the Coastal Plain section of the State, which have open or only moderately retentive sandy clay subsoils, it has generally been found most profitable to divide the whole fertilizer application into two parts, putting in one-half in the drill at planting and reserving the other half to be applied alongside the row as a side dressing about July 1. However, instead of this, if the soil is not of too open a nature, all the phosphoric acid and potash with one-half of the nitrogen in the form of cotton-seed meal, dried blood, or some other form of available organic nitrogenous material may be put in at planting of the cotton and the remaining half of the nitrogen reserved to be applied in a more immediately available form, like nitrate of soda, alongside the rows about July 1, after the plants have gotten well started in their growth and the roots have fairly well filled the soil.

LEAF TOBACCO SALES FOR FEBRUARY, 1914.

Pounds sold for producers, first hand	8,931,236
Pounds sold for dealers	379,904
Pounds resold for warehouses	601,560
Total	9,912,700

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THE BULLETIN

OF THE

NORTH CAROLINA

DEPARTMENT OF AGRICULTURE,

RALEIGH

Vol. 35, No. 5. MAY, 1914. Whole No. 196.

INSECT ENEMIES OF CORN

SUGAR-CANE BEETLE.

BEETLE AT WORK IN CORN STALK AT RIGHT. INJURED STALK AT LEFT.
NATURAL SIZE. SEE PAGE 41.

PUBLISHED MONTHLY AND SENT FREE TO CITIZENS ON APPLICATION.

Entered at the Post-office at Raleigh, N. C., as second-class matter, February 7, 1901, under Act of March 6, 1900.

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*Assigned by the Bureau of Soils, United States Department of Agriculture.
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‡In coöperation with Bureau of Plant Industry, United States Department of Agriculture.

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LETTER OF TRANSMITTAL.

Hon. W. A. Graham, *Commissioner.*

Sir:—I submit herewith manuscript for a Bulletin on "Insect Enemies of Corn." Corn is our most important crop, and the total damage done to it by insects is enormous. The Bulletin which we issued upon this subject in May, 1905, has been exhausted, and the matter which it contained has here been rewritten to include later observations and to avail ourselves of many excellent publications on corn insects which have recently appeared from other States, thus bringing, so far as I am able, the best present information into shape available to our farmers. The general plan of the older Bulletin has been retained, as also the illustrations.

I recommend its publication as the Bulletin for May, 1914.

Very respectfully,

Franklin Sherman, Jr.,

Entomologist.

Approved for printing:

W. A. Graham,

Commissioner.

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CONTENTS.

PAGE

Introduction 5

General Considerations 6

Cultural Considerations 6

Rotation, p. 6; Fertilization, p. 7; Fall or Winter Plowing, p. 7; Time of Planting, p. 7; Planting Increased Quantity of Seed, p. 7; Cultivation, p. 8; Selection of Lands, p. 8; Disposition of Remnants, p. 8; Ideal System to Avoid Insect Injury, p. 8.

Regarding Insects and Their Names 9

INSECT ENEMIES OF CORN.

Wire-worms 10

Remedies for Wire-worms 12

White Grubs 13

Remedies for White Grubs 15

Cut-worms 15

Remedies for Cut-worms 18

Corn Root-louse 19

Remedies for Corn Root-louse 21

Corn Bud-worm 21

Remedies for Bud-worm 23

Corn Bill-beetle (mention) 24

Corn-root Web-worm 24

Remedies for Corn-root Web-worm 25

Corn Stalk-borer 25

Remedies for Stalk-borer 28

Chinch Bug 29

Remedies for Chinch Bug 33

The Army-worm 35

The Fall Army-worm 38

Remedies for Army-worms (both kinds) 40

The Sugar-cane Beetle 41

Remedies for Cane-beetle 44

The Corn Ear-worm 45

Remedies for Ear-worm 49

Weevils 50

Remedies for Weevils 52

Lesser Corn Insects. 54

Seed-corn Maggot, p. 55; Flea-beetles and Leaf-beetles, p. 55; Red Spider, p. 55; Grasshopper, p. 55; Lady-beetle, p. 55; Stinging Caterpillars. p. 55; Other Caterpillars, p. 56.

Conclusion 56

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INSECT ENEMIES OF CORN.

By FRANKLIN SHERMAN, JR., Entomologist.

INTRODUCTION.

Nearly one-half of all the land planted in crops in North Carolina each year is devoted to corn. The yearly money value of the total crop is estimated at $70,000,000.

Insects are estimated to destroy approximately one-tenth of the total value of our crop products. Allowing that corn suffers its proportional share, we are brought to the conclusion that the corn crop in North Carolina suffers an average loss of $7,000,000 per year from insect pests.

Nor can it be said that this is an exaggerated estimate. What with wire-worms, cut-worms, bud-worms, bill-beetles, stalk-borers, chinch-bugs, ear-worms, weevils, and others, the corn plant certainly seems to suffer its full one-tenth loss. The writer has frequently known of cases in this State where one species of pest alone has destroyed from one-half to three-fourths of the entire crop; a total loss has been reported in some instances. Injury by insects frequently makes replanting necessary, and this is always a serious loss of time, labor, seed, and use of land. Putting the matter in its mildest light, the loss certainly runs well up among the millions.

The object of this Bulletin is to show how and where these losses occur, to describe the insects responsible for them, and set forth the remedies or methods which may be employed in preventing or avoiding these injuries.

A Bulletin on "Insect Enemies of Corn" was issued in May, 1905,* but the edition has been exhausted. The continued demand for information about corn insects makes a new issue desirable. The work of the county demonstration agents, the boys' corn clubs, the teaching of agriculture in many of our public schools, and many other commendable factors, have all increased the interest in the corn crop, and in the enemies which attack corn.

In the present Bulletin the descriptions of the insects and the account of injuries in North Carolina are based on our own observations, correspondence, etc. The accounts of life-histories, remedies, etc., are gleaned from all available reliable sources, including text-books, bulletins, etc., as well as our own observations. A great work yet lies ahead in the working out of the exact, detailed life-histories of our Southern corn insects and in determining with exact, scientific accuracy the degree of

*Vol. 26, No. 5, Bul. N. C. Dept. Agr., May, 1905, "Insect Enemies of Corn." F. Sherman.

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protection that can be secured from them. The most that we can pretend to do here is to present the general facts, with such recommendations for control as seem, from present even incomplete evidence, to offer the best hope of relief. The illustrations are the same as in the previous Bulletin.

GENERAL CONSIDERATIONS.

In dealing with insect pests on corn, it must be constantly remembered that the crop is of relatively low commercial value, the margin of actual profit is small, hence expensive measures are not justifiable except in limited areas where their use will prevent the insects from spreading over larger areas. It may not be profitable to spray a whole cornfield to kill insects, yet the spraying of a few rows or a certain portion of the field may be profitable if by that means the pest can be prevented from spreading farther. The small margin of profit on the crop as a whole renders it difficult or impossible to combat some of the pests satisfactorily.

Again, corn is grown on such large areas and there are so many individual plants in a field that the treatment of each individual plant is usually out of the question.

Therefore, in combatting many of the insect pests of corn we must rely on such methods of culture and handling of the crop as shall render it least liable to injury; in other words, the treatment must be *preventive* rather than *curative*—and this frequently necessitates taking the insects into account before the crop is planted, even in the very selection of the lands where it is to be planted, or, in severe cases, even modifying the manner of rotation of the crops which shall precede the corn. How far one is justified in going in recasting the plan of his farm operations to protect his corn from injury will of course depend upon how severe the injury is, and upon the value which he places upon the corn crop itself.

CULTURAL CONSIDERATIONS.

By changing or modifying the methods of culture much may be done to avoid insect injury. This is so important that we will consider it in more detail.

Rotation.—Any system by which corn follows grass or a growth of weeds is injurious, from the standpoint of insect pests. Where land just from sod is put in corn, the crop suffers more from wire-worms, white grubs, root web-worms and cut-worms than it does when it follows a cultivated crop like cotton. Suppose we have a field now in sod which we wish to bring into cultivation: A system of rotation which will give the minimum amount of insect injury to the corn might be arranged as follows: First year, plant the field in a small grain, and after that in peas. Second year, cotton, potatoes, cabbage or other cultivated crops.

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Third year, corn (peas may also be grown with the corn). Fourth year, small grain and peas again, and so on. A shorter system may be used, but it is *best* to have corn at least two years removed from a growth of grass or weeds, and it is *advisable* to have it separated from small grain by one year in a cultivated crop. Of course such a plan may not always be feasible, but it is best so far as avoiding insect injury is concerned, and the nearer we can come to it the better. The employment of peas in the rotation is beneficial from all points of view. Not only do they tend to improve the land, but they do not in any way render the corn more subject to insect injury.

Corn following corn year after year is also favorable to the increase of certain insects (stalk-borers), and a two-year rotation with merely cotton and corn is favorable to some pests, especially ear-worm and root-louse. Hence, while corn and cotton may follow each other occasionally, they should not always do so, and they should at least sometimes be separated by some other crop between them so as to interfere with those pests which feed on both cotton and corn.

Fertilization.—A crop of corn which has been put into healthy condition by fertilization, whether by commercial or farm manures, is better able to withstand and recover from insect attacks than one which has not been so aided. Here the peas serve a useful purpose. It has also been claimed that where heavy applications of kainit or other salty fertilizers are used the wire-worms, cut-worms and other underground insects are checked to a considerable extent.

Fall or Winter Plowing.—As a general rule, it may be poor policy to plow land in the fall and leave it bare all winter. If, however, a field which is in sod is to be planted in corn it will be well to adopt this method of fall plowing in order that the wire-worms, cut-worms and other soil-inhabiting insects may be starved out, killed by exposure, or driven away, before the crop is planted in the spring, especially if these pests are known to be usually destructive in the locality. The plowing should be deep, so as to thoroughly break up and pulverize the soil.

Time of Planting.—This has an important bearing on the amount of insect injury that the corn will suffer later on. Corn planted late is not so much hurt by either cut-worms or stalk-borers. In the eastern part of the State some good farmers claim that corn planted *very early* will often partially escape the bill-beetle (not always nor completely). In the eastern section also, very early (or very late) planting may avoid part of the injury by bud-worms; while in the western half of the State late planting of corn seems to be the best method of escaping bud-worms.

Planting Increased Quantity of Seed.—Injury by some insects, such as wire-worms, white grubs, bud-worms, and cut-worms, may occur largely before thinning time (especially if the corn is planted late), so that if

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an extra quantity of seed is planted a stand may be secured even if some is destroyed by insects. Any surplus that remains can then be gotten rid of by thinning. There used to be a commonly quoted rhyme in this connection:

"One for the cut-worm,
And one for the crow,
One grain to rot, and
Two grains to grow."

The idea here is the planting of extra seed so that there will be a stand left in spite of poor germination and damage to the young stalks. This is a very simple expedient, though it does not in any way decrease the number of pests.

Cultivation.—Frequent and thorough cultivation of the soil not only stimulates the corn to a better growth, but acts as a decided check to cut-worms, wire-worms, root-lice, and other insects living in the soil. The cultivation can be more thoroughly practiced when corn is planted in checks, so that it can be cultivated both ways, than when the ordinary method is used.

Selection of Lands.—Wire-worms and bud-worms are worse in lowlands. It should be remembered, therefore, that when other considerations do not interfere, it may be well to avoid the very low situations.

Disposition of Remnants.—Throughout the southern states it is a common custom to "pull" the fodder, leaving the stalks standing in the field, often with the shucks attached, until the land is needed for other purposes, when they are beaten down and plowed under. Such a practice is detrimental from the standpoint of one who wishes to avoid insect injury. If the fodder were cut at the ground (or as close to it as practicable) and the stalks and leaves shredded or made into ensilage, a reduction of insect injury should result, and the value of the fodder and grain would both be increased by the process. Many insects find hibernating places in these stalks and husks. Chinch-bugs, grain weevils, and stalk-borers are all favored by this custom of "pulling" and leaving the stalks, and all will be more or less reduced by abandoning the custom and making use of the shredder and the silo. Even the plowing out, raking together and burning of the stubs will sometimes be advisable.

In some of our extreme northeastern counties it is the regular practice of many farmers to burn the stalks, under the idea that this destroys bill-beetles; but we question the advisability of this, for the land needs the humus of the stalks. If the stalks be cut and fed as fodder or ensilage and the remaining *stubble* be plowed out, raked together and burned, the whole result, in our opinion, would be better.

Ideal System to Avoid Insect Injury.—Having gone into some detail with these cultural considerations, it is well now to summarize with a

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statement of the system to be followed if one aims to incur the minimum amount of insect damage to his corn crop:

The field should be on land well drained and of sufficient elevation not to be subject to overflow. It should be at least two years out of sod, and the year previous to corn should have been in some hoed or cultivated crop. If there is much growth of weeds or grass on the land, it should be plowed in the fall. The land should be deeply plowed, thoroughly prepared. The time of planting may be modified according to location and severity of insect pests, as already discussed. The young corn should be given frequent and thorough cultivation. At harvest the stalk should be cut at the ground and shredded or made into ensilage; the remaining stubble can be plowed out, raked together and burned.

The writer understands perfectly that such a system as this cannot always be carried out in all details, but he does claim that such a system will involve a minimum of insect risk, and the system is closely in accord with the best farm practice.

REGARDING INSECTS AND THEIR NAMES.

In considering the corn insects in this BULLETIN, we have confined the main discussion to those which have actually been known to do serious injury to corn in this State; the lesser pests are discussed briefly.

In discussing each pest, we have given both the popular (common) and scientific names of the species, and have indicated the *order,* and under the order the *family* of insects to which each belongs. This makes for accuracy and definiteness. It should be remembered that the *Order* is the more comprehensive group, and that each order is divided into a number of *Families.*

The great majority of our insects fall into seven orders, and there are some ten or twelve other smaller and less important orders. These seven principal orders are:

1. The *Orthoptera* (Or-thop'-te-ra), including the Grasshoppers, Katydids, Crickets, Roaches, etc.
2. *Hemiptera* (He-mip'-te-ra), Bugs, such as Chinch Bug, Squash Bug and Terrapin Bug, Plant-lice and Scale-insects.
3. *Neuroptera* (Neu-rop'-te-ra), Lace-wings, Dobsons, etc.
4. *Lepidoptera* (Lep-i-dop'-te-ra), Butterflies and Moths.
5. *Diptera* (Dip'-te-ra), the true two-winged Flies, such as House-flies, Mosquitoes, Blow-flies, Horse-flies, etc.
6. *Coleoptera* (Co-le-op'-te-ra), Beetles, such as Potato-beetle, Bill-beetle, Flea-beetle, June-beetle, Tumble-beetle, Tiger-beetle, etc.
7. *Hymenoptera* (Hy-men-op'-te-ra), Bees, Ants and Wasps.

Of these seven orders the Neuroptera, Diptera and Hymenoptera contain no very serious pests of corn, but all the others will be found referred to in the following pages.

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It is believed that this arrangement will be of use to those who are interested in learning how to recognize the different orders of insects, and to all readers who wish to make their knowledge exact.

INSECT ENEMIES OF CORN.

WIRE-WORMS (Several Species). Order *Coleoptera.* Family *Elateridæ.* (Also sometimes called "Drill-worm.")

Description.—Slender, smooth, firm-bodied, yellowish-brown worms (larvæ), attaining length of one to two inches, which destroy the corn by eating the seed before it comes up, or by eating roots, or into the stalk just below the surface of the ground, causing the center of the growing part to die. The adult insect is a "Jack-snapper."

Injury in North Carolina.—Any insect which does its work underground is not likely to attract attention except in cases of serious injury; hence the complaints made of these pests cannot be an adequate measure of the damage done by them. It is quite certain, also, that farmers often confuse injury by Wire-worms with that done by bud-worms, so that what is attributed to one may in reality be due to the other.

From the letters of complaint which have come to us in regard to Wire-worms, we give the following quotations, all of which throw some light on the nature or extent of damage or the habits of the insects:

"It gets in the root of the corn and kills it at any age from time it comes up until a foot high. In a 20-acre field I believe they have killed 14 per cent, and are still killing. They do most damage in lowlands."

"A yellow worm works in the roots and kills the corn in low wet land."

"Very destructive to corn on black lowlands. They attack the corn from the root and go up the pith and kill it entirely."

"Destroying the corn in this county before it gets out of the ground; my bottom-land is thoroughly infested. Many of my neighbors are in the same position as I am."

"Damaging corn in meadow after sod."

"Present by the bushel in a piece of my land this year."

It is not to be inferred that Wire-worms attack only corn. They feed on roots of many plants, also on seeds and tubers. One correspondent sent an irish potato which had been bored through and through by them. Some feed mainly or exclusively in decaying vegetation, rotting wood, etc. In this State they are a recognized tobacco pest.

While on a tour through the Piedmont counties to inspect wheatfields in the middle of April (1905), the writer several times noted more or less injury to wheat by Wire-worms. No doubt corn sown on similar land suffered in the same way, only in *greater degree,* since the number

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of corn plants is small compared with wheat and the injury would be more concentrated. The following extracts from my notes on this trip will be of interest in this connection:

Greensboro, April 11, 1905.—Noted injury to wheat by Wire-worms eating off stem and roots at and near surface of ground. Noted at several places, though never serious.

Lexington, April 12, 1905.—In one field found very considerable injury by Wire-worms. Land had previously been in broom-sedge, as evidenced by tufts of sod in the field.

Statesville, April 13, 1905.—Noted some injury.

On April 20 (1905) the writer went to Warren County to investigate a Wire-worm outbreak. The infested field was a fine piece of meadow-land, reclaimed from swamp by drainage, and was cultivated (to corn) the year before for the first time, when Wire-worms destroyed practically every stalk. During the summer the land grew up in grass and weeds again and was not plowed until spring, when the soil was found to be still badly infested. The larvæ were still to be found in almost any foot of soil examined; they were apparently of different ages, some about full-grown. No pupæ nor adults were found.

FIG. 1.—Adult and larva of Wire-worm. It is the larva or worm form that does the damage. The adult beetle is known as a "Jack-snapper" and does no harm other than to lay the eggs.

(After Comstock and Slingerland.)

There are many species of Wire-worms, and though the kinds cannot always be distinguished in the Wire-worm stage, yet of the adult beetles over seventy species are already known to occur in North Carolina, and there are probably as many more not yet on record. But it is probable that only a few of our species are seriously destructive.

In June, 1911, a correspondent sent adult beetles of Wire-worms and said they were doing serious injury to his corn, but his description fitted the work of the Wire-worms themselves. No doubt the larvæ were still doing injury, but some were coming out in the mature beetle form, and it was these which he found.

*Life-history.**—Wire-worms are the young, or larvæ, of the beetles which are called "Jack-snappers," "Snap-jacks," "Click-beetles," "Hominy-beaters," "Elaters," "Thumping-beetles," and other similar names. The beetles have these names because of their power to spring suddenly into the air when placed on the back.

*Much of what is known of exact life-histories of Wire-worms comes from the work of Dr. Forbes in Illinois. (Bul. 44, Ill. Exp. Sta., "Ins. Injuries to Seed and Roots of Corn," May, 1896.) Extensive experiments are also reported by Professors Comstock and Slingerland of the N. Y. (Cornell) Exp. Sta.

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The following account will give a general idea of the history of those species that attack corn, the details probably varying somewhat in the different species:

Many of the adult beetles pass the winter in dead wood, under bark, under trash, boards, leaves, at the base of tufts of grass, etc. In the summer they lay eggs, usually depositing them in grassy places. The larvæ hatching from the eggs are slender, smooth, yellowish-brown in color and firm in texture, and are called "Wire-worms." They burrow through the soil, feeding on various seeds and roots which they may find. It is thought that it takes most species from two to three years to reach maturity. Then they change to the stage known as the *pupa* in a cell in the soil. While in the pupa state they are quiet and take no food, but are going through the change from larvæ to adult beetles. After a few weeks in the pupa state the insect changes to an adult beetle. Some of the beetles emerge and pass the following winter in sheltered places; others do not emerge until the following spring.

Summary.—It will be noticed from the foregoing account that Wire-worms are more destructive on lowlands, and that they are worse on lands which have been in sod. They feed on seeds, roots, and stems. It is probable that they do not attack corn or other cultivated crops because they especially like them, but because when sod lands are broken up they are already in the soil, their natural food is destroyed, and they must take what is planted. It takes from two to three years for a generation to reach complete maturity, and adults deposit eggs mainly in sod lands. With these facts in mind, we can better appreciate the recommendations which follow.

REMEDIES.

The first consideration in attempting to avoid injury to corn by Wire-worms is not to allow corn to follow directly after sod. If corn must follow sod, plow the land in the fall and stir once or twice during the winter. These measures will starve and kill by exposure many of the larvæ and will break open the little cells in which the newly formed adults are passing the winter and kill the insects. By avoiding low lands (especially low *sod* lands) much injury will be averted. Good fertilization and frequent tillage will also check the insects or enable the corn better to recover from their attacks.

In regard to corn after sod, it should be remembered that most species of Wire-worms are thought to take two or three years to become full-grown, hence it is well to have the land in some other crop not so subject to injury during the first year from sod, so that the majority of the insects will have had time to mature and deposit their eggs elsewhere.

But Dr. Forbes in Illinois states that they "are much more likely to do serious mischief the *second* year after the breaking up of the sod," which would indicate that in severely infested fields it would be better

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to have some crop other than corn on the land for *two years* after sod.

In Massachusetts, Dr. Fernald reported good results by planting seed coated with gas-tar and then dusted in a bucket of fine dust and Paris-green sufficient to give the corn a greenish color, this apparently repelling the insects and not affecting germination.[1]

The cultural methods here referred to are further discussed under the heads of Rotation (p. 6), Fertilization (p. 7), Fall Plowing (p. 7), Planting Increased Quantity of Seed (p. 7), Cultivation (p. 8), and Selection of Lands (p. 8).

WHITE GRUBS (Several Species).

Order *Coleoptera*. Family *Scarabæidæ*.

Description.—Thick-bodied whitish grubs reaching a length of 1½ inches; when disturbed, often curling up tightly; infesting sod lands or fields where much manure or decaying vegetation is present; living underground and doing damage by eating roots from corn, grasses, or other plants. When fully grown they change to brown "May-beetles," or green "June Bugs."

Injury in North Carolina.—As with other underground insects, injury by White Grubs is apt to pass unnoticed unless it becomes very serious, and also their presence in gardens and cultivated fields is taken so much as a matter of course that definite complaints of their injuries are infrequent in this State. But it cannot be otherwise than true that the total damage by them to our corn crop is considerable.

During inspection of wheat-fields in the spring, we have found these Grubs doing injury, though usually not to a serious extent.

White Grubs have been complained of to us as a pest in gardens, lawns, greenhouses, in grass fields, and in farm crops. But the most serious and definite complaint we have ever had came in August, 1913, from Mr. George F. Ogilvie, Oakwoods, Wilkes County. As this was evidently a typical White Grub outbreak, I quote from Mr. Ogilvie's letters, as showing the extent to which these pests may do damage:

"I have a few patches that I have been manuring up with stable manure, and at this time thousands of large White Grubs work under the manure. They throw up the dirt until one's feet sink in it. Where I have sown small seeds like spinach, they have completely ruined it. I have used on some plats a very large quantity of ashes, and yet the grubs are everywhere, even where you can see the ashes in the land."

(LATER) "Since I wrote you, they have been worse. I resowed my spinach plat, and they have again completely ruined it. I never saw anything like it; the whole surface of the ground is heaved and churned up until one sinks almost over the shoes."[2]

---

[1]This statement from "Insects of Farm, Garden, and Orchard," by E. D. Sanderson, p. 83. I have not at hand the original report on the Massachusetts experiments.

[2]An interesting fact in this connection is that twelve years before this time, when I was in that vicinity on other work, Mr. Ogilvie was mentioned to me as a man who took special pains to manure his land heavily.—AUTHOR.

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We have indicated that there are several different species of the White Grubs. As with the wire-worms and cut-worms, many of the species seem to do but little injury, while the greater part of Grub injury is probably due to only six to a dozen species. Of the groups of beetles to which they belong, however, we have evidence of not less than thirty-five to forty kinds in the State, with no doubt many more awaiting discovery.

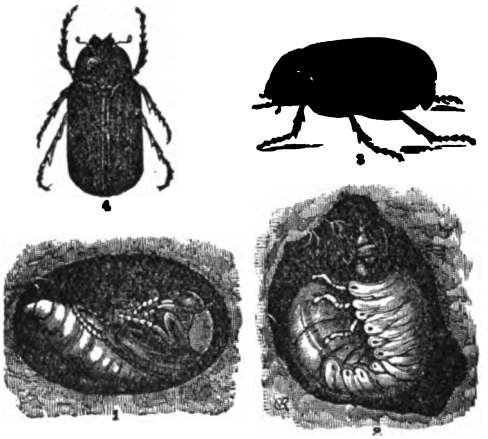

FIG. 2.—White Grubs. Showing adult beetles at 3 and 4. Larva eating roots of plants at 2, and pupa at 1.

(After Riley, Div. Ent., U. S. Dept. Agr.)

Life-history and Habits.—The most comprehensive work in this country on the life-histories and habits of White Grubs and their adult beetles has been done at the Illinois Experiment Station under Dr. S. A. Forbes.* But in the space of this BULLETIN we can only give a general condensed account of the life-history.

The adult beetles appear in spring and early summer; they are the common brown "May-beetles" which often enter our houses at night, or the green "June-bugs," so familiar to children. The beetles mate and the females deposit their eggs preferably in grassy or weedy fields. The eggs hatch into the "White Grubs," small at first, but growing with age to from 1 to 1½ inches in length, feeding upon roots of many plants. The exact length of time required for the Grub to attain full growth is uncertain, but seems to be from two to three years. It then changes to a pupa, in a cell in the soil, and the pupa changes to a mature beetle, which, however, may not emerge to live an active beetle life until the following spring. In the writer's personal experience it is a common thing to unearth the adult beetles in gardens in fall, winter, or spring.

*Among the several publications on this subject by Dr. Forbes I have been especially interested in Bul. 116, Ill. Exp. Station, "Life-history, Habits, etc., of White Grubs."

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No doubt some species complete a generation quicker than others, or even in the same species the period may vary according to heat or cold, moisture or dryness.

Every careful observer knows something of the habits of the adult beetles. The green June-beetle usually appears at Raleigh around the first of July, and may be found abundantly feeding on ripe figs, grapes, peaches, and other fruits. The brown May-beetles are evening or night fliers, and often congregate on trees at dusk, where they eat the foliage.

REMEDIES.

Hogs, chickens, and some wild birds are fond of White Grubs, and to some extent can be made use of in combatting these pests. In garden plats or in small patches of corn much can be done by encouraging poultry to follow the plow or the spade, or by merely gathering the Grubs which are exposed and feeding them.

Cornfields which are known to be badly infested by them can surely be largely freed from them by turning in hogs after the crop is off, especially if by scarcity of feed or otherwise they are encouraged to root diligently. Dr. Forbes reports a case in which 100 pigs destroyed over 90 per cent of the Grubs in a badly infested 10-acre field in less than a month.

As the Grubs are more likely to be abundant and destructive in lands taken from sod, their injuries to corn can in some measure be prevented by putting lands fresh from sod in some other crops for the first year (or, better, two years) by which time the majority of the Grubs will have matured.

See, also, Rotation (p. 6), Fertilization (p. 7), Cultivation (p. 8).

CUT-WORMS (Several Species). Order *Lepidoptera*. Family *Noctuidæ*.

Description.—Rather stout-bodied, soft, brown, blackish or grayish caterpillars, which remain concealed during the day and do great injury at night by eating off various kinds of young succulent plants at or near the surface of the ground.

Injury in North Carolina.—Everybody knows what Cut-worms are. So well known and so universally common and destructive are they that their injuries in ordinary seasons excite no particular interest or comment. Everybody takes it as a matter of course to lose a part of his cabbage, tomatoes, tobacco, corn, or any other green succulent crop, from their ravages. Like the potato-beetle and the house-fly, people take them so much as a matter of course that many persons give them no serious attention, and the complaints received of their injuries is in no sense a measure of their destructiveness. Most of the complaints that are made refer to their injuries in gardens, or flower-beds.

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In 1901, specimens were sent from Moore County with the report that they were a scourge that year, and that the correspondent could not get a stand of melons until after the worms matured; he had found as many as ten or twelve around one dewberry vine. He also reported them as destroying beans, cabbage, leaves on young peach trees, etc.*

During 1905, reports of serious Cut-worm damage were frequent, indicating damage to many crops, including corn, cabbage, and tomatoes. Cut-worms are also recognized as a regular and serious pest to tobacco.

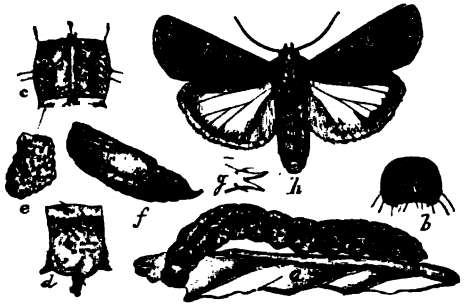

FIG. 3.—The Granulated Cut-worm (*Feltia annexa*), showing larva (*a*), pupa (*f*), adult moth (*h*), and details of structure.
(After Riley and Howard, Div. of Ent., U. S. Dept. Agr.)

Life-history and Habits.—As with the wire-worms, so with Cut-worms: there are a number of different species concerned. They are all the caterpillar stage, or larvæ, of moths, and the family *Noctuidæ* to which they belong contains upward of two thousand species. The larvæ of all of these would not be considered as true Cut-worms, however, and of those which could be truly classed under that name there are probably not more than thirty or forty species that are ever serious pests in the eastern United States. From our scattered observations we believe that 95 per cent of all the Cut-worm injury in this State is caused by not more than six or eight species.

Much work yet remains to be done in rearing our southern Cut-worms to the adult state before it will be possible to give in detail the life-history of all of our common species. Some species mature and emerge as moths in early summer, while others emerge as moths in the fall. Thus far we have observed no species which is seen in the adult state both in summer and fall; so that it seems that they are all single-brooded, some of the species emerging as moths in early summer and other species emerging in the fall.

Mr. C. S. Brimley of Raleigh, who has long taken an interest in collecting, rearing, and studying insects, reared to maturity a number of

*From letter from R. W. Caviness (deceased). Mr. Caviness was an excellent observer.

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Cut-worms during 1903-'04. The notes here given refer to the dates on which the adult moths emerged in Mr. Brimley's cages, or when adult moths were captured:

The Granulated Cut-worm.—*Feltia annexa*, Treit, August 29, September 20, October 7, 12, 1903.

Feltia hirilis, Grote, September 17, 25, 1904.

The Dingy Cut-worm.—*Feltia subgothica*, Hawworth, September 12, 27, 1904.

Prodenia commelinæ, Sm. and Abb., August 17, 1904.

Peridroma saucia, Hub., June 22, 23, 24, 1903.

Other species, not identified, emerged as follows: Species No. 1 (spring species), June 4, 28, 1903. One captured (not bred) May 30, 1902. Species No. 2 (fall species), October 7 (2 specimens), 12, 1903.

From these notes it seems that for the spring species June, and for the fall species September and October, are the principal months of activity and egg-laying by the adult moths.

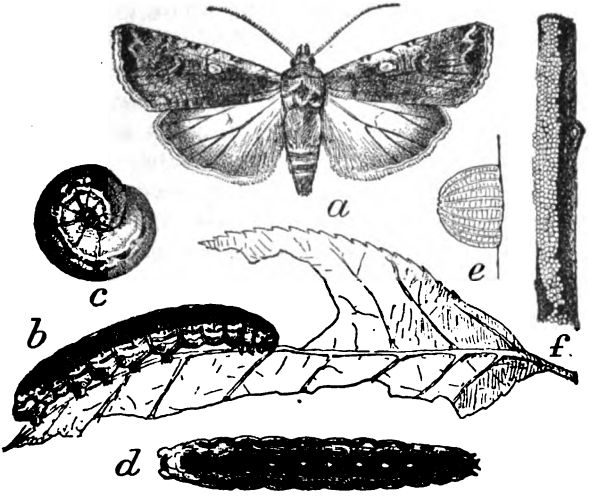

FIG. 4.—Another Cut-worm (*Peridromia saucia*) showing adult moth (*a*), larva (three views) (*b*, *c* and *d*), egg (enlarged) (*e*), and eggs in natural position on grass stalk (*f*).
(After Howard, U. S. Dept. Agr., Div. Entomology.)

Of course, the details in the life-history of a species will vary somewhat according as it matures in the spring or in the fall; but the following will serve as a condensed account:

The larvæ (the destructive Cut-worm stage) pass the winter in the earth, or on the surface under such shelter as they can find, in a partly grown condition. The long fast of winter gives them ravenous appetites when the warm days of spring arouse them to activity, and they feed on any green succulent young plants that they can find. Some species have the habit of climbing trees or other plants to eat the tender expand-

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ing leaves, but those that are most destructive to corn do their damage by eating off the young stalks at or near the surface of the ground. Sometimes the severed stalk (if it be young and small) is dragged partially into the ground. The worms usually remain quiet during the day and feed mainly at night. Sometimes, however, they will work during the day if the weather be cloudy. Cool weather seems to sharpen their appetites. When the larvæ become grown (which varies according as the moth is to emerge in spring or fall), they change to *pupæ* in the earth, an inch or so under the surface, sometimes only barely covered by the soil. Those that are to emerge in spring change to pupæ about the middle or latter part of May; and it is because these larvæ *become mature* at this season that they cease their injuries, and not usually because of any epidemic of disease among them. In the pupa state they are without legs or wings, and take no food—it is simply a stage of transition from the larvæ to the adult moth. After a few weeks in the pupa stage the adult moth bursts from the pupa-shell. Most of the Cut-worm moths are dull gray or brown in general color, marked with lighter streaks or spots, and with the hind wings lighter in color, sometimes of a pinkish hue. When the wings are expanded they measure from one to two inches from tip to tip. These moths fly mostly at night and are often attracted to bright lights and not infrequently enter houses and flutter about the lamps or walls. The females deposit their eggs on trash, grass or weeds, in sod or weedy lands, and the larvæ become partly grown by winter and hibernate as already explained.

Summary.—Cut-worms are the larvæ of night-flying moths. They pass the winter as larvæ, eat voraciously in the spring, become mature, pupate, and emerge as moths in early summer or fall, according to the species. June, September and October seem to be the principal months for egg-laying. Eggs are deposited in weedy or sod fields, after which the moths die. The larvæ pass the winter in a partly grown condition in the fields. With these points clearly understood it will be easy to comprehend the following remedial suggestions:

REMEDIES.

As the eggs are laid principally in sod or weedy lands, corn planted on land just from sod or weeds is likely to suffer from Cut-worms. They are often numerous in clover sod also; yet corn after clover does so remarkably well that in general it pays to take the risk. If the corn must come after a growth of grass or weeds, then by plowing the land in fall or winter many of the Cut-worms will be killed or starved before spring. This result has been several times reported by farmers. In 1905, Mr. G. M. Bentley, at that time an assistant in this office, made some observations on Cut-worm injury to tobacco in Wake County. On a small plat which was plowed March 19th, he found seven plants destroyed, while on an adjoining plat of same size, with same number of

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hills, plowed one month earlier (February 22d), he found only two plants destroyed. So far as this observation went, therefore, it showed that land plowed in winter was much less infested than land which was not plowed until spring.

By delaying the planting until moderately late in the spring, those Cut-worms which mature to moths in the spring will be nearly or entirely grown, and will therefore not do serious injury, and the extra time can be given to a more thorough preparation of the land. Frequent cultivation as soon as the corn is up will also disturb the Cut-worms in the soil and deter them in some degree.

But if we must put a piece of spring-plowed sod or weedy land into corn, and wish to plant at the normal season, there is still a method (not always easy or entirely satisfactory, perhaps) by which we may combat the Cut-worms. When the land is plowed in the spring much of their food is destroyed and they become hungry. It is then, after breaking and harrowing the land and before the corn is planted, that it is possible to poison them. Clover or other green and succulent vegetation may be poisoned with Paris-green and distributed through the fields as a bait to the worms. The clover may be sprayed as it stands and then cut; or perhaps the better and more thorough plan would be to cut it and dip it into a barrel of the poisoned solution. The Paris-green for this purpose should be thoroughly mixed with water at the rate of about one pound to the barrel (40 to 50 gallons) of water. Arsenate of lead may be used instead of Paris-green, at the rate of five or six pounds to the barrel. Paris-green and wheat bran have been used in gardens, at the rate of about one ounce of the poison to two or three pounds of the bran. A mash made of bran, Paris-green and water, and sweetened with molasses, has also been used by gardeners.

But in field operations with corn grown on a large scale, the main practices to be relied upon are:

(1) Avoidance of corn after sod or weeds;

(2) Fall or winter plowing, or very early in spring, if sod lands are to be put in corn;

(3) Moderately late planting.

For further discussion of the methods mentioned, see Rotation (p. 6), Fall Plowing (p. 7), Time of Planting (p. 7), Planting Increased Quantity of Seed (p. 7), Cultivation (p. 8).

THE CORN (AND COTTON) ROOT-LOUSE. (*Aphis Madai-radicis*, Forbes.)

Order *Hemiptera*. Family *Aphididæ*.

(Also called "Blue-bug," "Blue-louse," "Blue Root-louse.")

Description.—A small greenish or bluish plant-louse attacking the roots of young corn, causing it to be of slow, belated growth or unhealthy color. Their presence often indicated by ants entering and leaving the ground at the hill.

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Injury in North Carolina.—In this State this Root-louse has not often been reported on corn, though it does injury to this crop. It is much more often reported as a pest of cotton, and the writer believes that the first published record of it as a really serious cotton pest was in a Bulletin of this Department.[1] Injury to corn, however, has been reported several times in recent years, from the counties of Bladen, Caldwell, Forsyth, Gaston, and Union. As it is a pest of cotton chiefly in our eastern counties, has been reported on corn to the edge of the mountains, and is known as a corn pest throughout the entire State of Illinois, we must conclude that it does attack corn throughout the entire length and breadth of North Carolina, even though definite complaints of it on this crop have been few. Like the other underground insects, it is likely to pass unnoticed except in the most aggravated cases.

Life-history.—Here again we must acknowledge our indebtedness to the work of Dr. Forbes in Illinois. Not only was he the original describer of the Corn Root-louse as a species, but what is known of its exact life-history comes largely from the work of his office. Working in a great State the chief crop of which is corn, he has studied carefully the insect enemies of that plant, and many of his publications have discussed this Corn Root-louse, and the relation which the attendant ant bears to it.

Dr. Forbes says that the first generation of Root-lice in the spring are all wingless, and if the plants on which they feed remain thrifty, many generations in succession will be wingless; but that if the plant becomes overcrowded by them and seems likely to die, then many of the oncoming generations have wings which enable them to migrate in search of new plants. Such stray lice are found by the ants which attend them, and are quickly placed on roots of plants which will support them—on corn if in a cornfield. Here they multiply until the approach of winter. All this time, from the opening of spring through many generations, *only female* Root-lice are produced, all being born alive (no eggs); but as cold weather approaches in fall, the last generation contains both *males and females;* these mate, and the fertilized females *lay eggs* which pass the winter and hatch to wingless females in the spring. In Illinois Dr. Forbes finds an average of about sixteen generations per year.[2] The louse is largely dependent upon the cornfield ant, for this ant stores the eggs of the Root-louse in its burrows over winter, and when they hatch in spring they place the young lice on the roots of plants upon which they can feed. The lice secrete from their bodies a sweetish substance known as "honey-dew," and it is to obtain this that the ants attend the lice. The ants themselves do not hurt the corn (or cotton), nor do they give birth to lice, nor do they de-

[1]Vol. 29, No. 6. Bul. N. C. Dept. Agr., June, 1908, "Insect Enemies of Cotton," by F. Sherman, p. 17.

[2]Account condensed from "The Corn Root-aphis in Illinois." Circular of Ill. Exp. Sta., Jan., 1913, by S. A. Forbes.

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stroy the lice. They are an entirely distinct species of insect and attend the lice for the purpose of securing the honey-dew.

Although with us this Root-louse is recognized as a pest only on cotton and corn, it is known to feed on the roots of many other plants which may tide it over in places or in seasons when corn or cotton are not within its reach.

REMEDIES.

Throughout our cotton-growing region the time-worn two-year rotation of corn one year, cotton the next, and then back to corn again, acts directly in favor of the increase of this louse, for it feeds upon the roots of both these plants. Hence a rotation which shall at least every third year put some crop on the land other than cotton or corn would surely offer a hope of relief.

Corn (or cotton) fields which have been infested may be deeply winter-plowed to break up the ants' nests, the soil being deeply cultivated (or disked) before being planted to the next crop.

It stands to reason that thorough preparation of the land, liberal fertilization, and frequent cultivation will all tend either to discourage or interfere with the ants or the lice, and will encourage the crop to healthy growth which may withstand moderate attacks.

THE CORN BUD-WORM. (*Diabrotica 12-punctata*, Oliv.)

Order *Coleoptera*. Family *Chrysomelidæ*.

(Also called "Root-worm" and "Drill-worm.")

Description.—A slender worm or grub, half an inch long, yellowish white, destroys young corn by eating into the stalk below ground, killing the central portion. Worse on lowgrounds in cool belated seasons. The adult beetle is about one-third inch long, yellowish green with twelve black spots, feeding on many plants and often destructive on squash and related crops.

Injury in North Carolina.—The Corn Bud-worm is a pest of long standing in this State, so much so that a certain amount of injury by it is taken largely as a matter of course. From the very considerable number of letters which have come to us regarding it, we quote from several to show the nature of the injury as the farmer sees it:

"Have been troubled with something that kills my corn from time it comes up until 6 or 8 inches high; looks like a worm had cut the heart of the corn under the ground near the root; the heart dies and the stalk is worthless."

"Corn Bud-worms are the worst insect I have to contend with. On low bottom-lands they kill about one-half of it in cool spells. They work about an inch from the grain of corn."

"A great deal of my corn is killed by Bud-worms when about a hand high."

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In June, 1907, I was told that it was unusually destructive that year in Henderson County, and that it is regularly worse in wet, cool seasons.

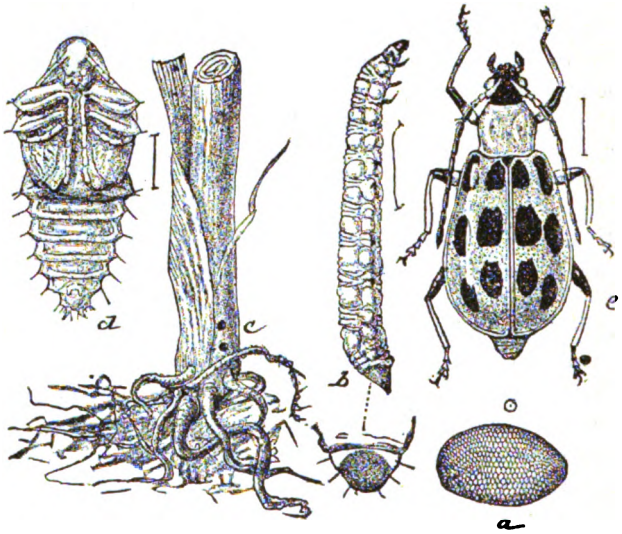

FIG. 5.—The Corn Bud-worm, showing adult beetle (*e*), larva (*b*), pupa (*d*), and egg (*a*), all enlarged; natural sizes indicated by lines, etc., at side. Work on corn shown natural size at *c*.
(Redrawn from Riley, Div. Ent., U. S. Dept. Agr.)

Field Notes on the Adults.—Our own notes throw some light on the habits and behavior of the adult beetles.

Hibernation.—The winter is passed in the adult stage, presumably under any adequate shelter. In December, 1906, I found many sluggish adults inside of cracked gourds in a field in Brunswick County, and this may be a common place for hibernation. On October 31, 1900, at Raleigh, I found many eating *into and inside of* gourds which were green, but the vines of which were dead. But I *believe* that many (perhaps most) of them pass the winter under rubbish or trash.

Emergence in Spring.—March 10, 1904, I found adults common in blooming strawberry fields in Pender County. By March 25, same year, had noted them feeding on opening leaf-buds and flowers of fruit trees at both Southern Pines and Raleigh. In 1907 I noticed first adults in flight at Raleigh on March 22. In 1908, on March 25, adults were plentiful at Raleigh feeding on many kinds of new vegetation. In 1909, April 16, at Louisburg, Franklin County, I found them abundant on young pear foliage, many females heavy with eggs; though an assistant noted adults mating freely as late as May 17 in 1907, at Raleigh. In 1913 I saw the first active adult in garden at Raleigh on March 29.

Later Habits of Adults.—In October, 1900, I noted that adults were common on goldenrod and aster. On May 17, 1907, Mr. R. S. Wog-

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lum, assistant, noted them abundant on squash at Raleigh, as many as 25 on one leaf, and mating was common. At Andrews, Cherokee County, on May 20, 1911, I found adults plentiful on cabbage in garden, and indicated their presence on beans. As a matter of fact, the adults feed freely on leaves and flowers of many plants, and are not confined to any particular kinds.

Life-history.—Prof. F. M. Webster[1] has recently published an account of this pest, in which he has brought together the observations of many workers, and concludes that "from all available information it appears that the egg period varies greatly and may require from 7 to 24 days, the larval (worm) period 15 to 35 days, and that of the pupa (between the worm and the adult beetle) from 7 to 13 days."

Dr. Chittenden[2] records one individual adult beetle as having laid 209 eggs, though this is probably above the average, and he concludes that there are three broods at Washington, and possibly four further south.

Briefly stated, the general life-history of the insect seems to be about as follows: The adults pass the winter, emerge very early in spring, feeding on flowers and foliage, mate, and lay eggs at the base of corn or other plants in which the worms feed; the worms on hatching from the eggs, burrow into the root or stalk of the plant attacked, become grown in a few weeks, leave the plant and change to the pupa state in the earth close by, from which the beetles emerge one to two weeks later. Several broods are produced in the course of the season.

Two farmers in North Carolina, Dr. Porter of Pender County and Mr. James Middleton of Wake, placed jars over infested corn plants and thus bred the adult beetles.

REMEDIES.

The *time of planting* appears to be the greatest factor in preventing Corn Bud-worm. The complaints quoted show it to be worse early in the season, or in cool spells of early spring; hence the general later planting of corn would suggest itself.

In South Carolina Mr. W. A. Thomas[3] divides his State into three general regions corresponding to our (1) coastal plain, (2) lower piedmont, and (3) upper piedmont, and concludes (in *South Carolina,* be it remembered) that in the first or eastern of these divisions corn planted after May 5th will escape the worst of the injury; in the second or middle region, after May 12th, while in the west, after May 19th. For our own State, we should be inclined to make all the dates from one to two weeks later to allow for difference in latitude and elevation.

But the experience and testimony of farmers themselves cannot be wholly disregarded, at least not unless the most exact and definite evi-

[1]Bul. No. 5, U. S. Dept. Agr., Sept. 27, 1913, "Southern Corn Root-worm or Bud-worm." F. M. Webster.
[2]Cir. 59, Bur. Ent., U. S. Dept. Agr., "Corn Root-worms." F. H. Chittenden, March, 1905.
[3]Bul. 161, S. C. Exp. Sta.; "The Bud-worm of Corn." W. A. Thomas, March, 1912.

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dence to the contrary can be produced; and in North Carolina many farmers insist that they can escape the bulk of Bud-worm injury to their corn by *either* very early, or late, planting.[1] An intelligent farmer in Yadkin County at the Farmers' Institute in August, 1908, said that with him corn planted in either April or June was not much hurt by Bud-worms, but if planted in May, it was hurt. His testimony is typical of that offered by many others, though somewhat more explicit.

If one's experience shows that *either* early or late planting will escape bud-worm injury, then we would incline to give the late planting the preference, as it will have the tendency to avoid other pests (cut-worms, stalk-borers), and also allows opportunity for better preliminary preparation of the ground.

It has been noted that Bud-worm is worse on lowlands, hence the use of other lands for corn when entirely available and convenient, will help to avoid injury.

As with many other corn pests, ample cultivation and liberal fertilization will enable the corn to recover from slight attacks. Also the planting of liberal amount of seed will provide enough plants for a "stand," even though some is killed by Bud-worm.

THE CORN BILL-BEETLE.

Order *Coleoptera*. Family *Calandridæ*.

(Also called "Bill-bug," "Klew-bug," "Curlew-bug," etc.)

Description.—A grayish to blackish hard-shell beetle about ½ inch long, with strong down-curved beak or snout; damages corn by puncturing the stalks near the ground.

This is one of the worst corn pests in the eastern part of the State. Many points in regard to its life-history, habits, and methods of control are not yet entirely clear; and as it is now under special investigation by Prof. Z. P. Metcalf of our Experiment Station, it is considered best to omit any effort at detailed discussion.

THE CORN-ROOT WEB-WORM. (*Crambus caliginocellus*, Clem.)

Order *Lepidoptera*. Family *Pyralidæ*.

Description.—Whitish caterpillars with small black spots on body, attaining length of ½ to ¾ inch; attacking young corn near the ground; each caterpillar surrounding itself with a slight web.

Injury in North Carolina.—Only a few complaints have come to us regarding this insect, and we shall devote but little space to it. Yet we feel sure that in the total it must do considerable injury, for the adult moths are very common in grassy fields at Raleigh in summer and the insect is of wide distribution.

[1]The idea of early planting to escape bud-worm also exists in Alabama. Cir. No. 8, Ala. Exp. Sta., March, 1911, "Bud-worms in Corn," by W. F. Turner, p. 6.

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Life-history and Habits.—The adult insect is a delicate little moth of silvery-gray color, which frequents grassy fields, where the eggs are laid in summer and fall. The larvæ normally live upon grasses, eating into the stems or bulbous roots at the surface of the ground. When corn is planted on land just from sod the larvæ are often already present in great numbers, and being deprived of their natural food of grasses, they attack the corn, eating into the stalk at the surface of the ground, each larva being somewhat protected by a loose web which acts as a barrier to predaceous enemies and parasites. When grown the larva is about three-quarters of an inch in length, yellowish-white, pinkish, reddish, or even of a reddish-brown color, being quite variable. In midsummer they change to the pupa state at or close to the base of the plant, and emerge as moths two weeks later. Eggs are at once laid in grass lands, where the partly grown larvæ pass the winter and are ready to commence feeding as soon as spring opens.

REMEDIES.

By avoiding corn immediately after sod much of the injury by this insect will be averted. If sod land is to be planted in corn, fall plowing will kill many of these insects by exposure or starvation.

THE LARGER CORN STALK-BORER. (*Diatræa saccharalis*, Fab.)
Order *Lepidoptera*. Family *Pyralidæ*.
(Sometimes called "Shatter-worm.")

Description.—Whitish caterpillars with brown or black specks, reaching length of about 1 inch, injuring corn by boring into the stalk and (when corn is young) into the terminal growing part, causing weakness and distorted growth, rendering the plant worthless when the attack is severe. Injury becomes evident in June. The adult moth measures about an inch from tip to tip of wings, is yellowish-brown, and is an active flier.

Injury in North Carolina.—This is a prevalent pest in this State and at times very destructive. While most of the complaints have come from the southern and southeastern counties, we believe it to be present throughout the State, at least east of the mountains. We have reports of it from the following widely separated counties, as well as many others: Alamance, Columbus, Duplin, Edgecombe, Mecklenburg, Rutherford, and Warren. It is considered to be rather a southern insect, and is a standard pest of sugar-cane in Louisiana.

At Red Springs, Robeson County, in 1902, the writer found it abundant and destructive, as many as six of the worms being taken from a single stalk, and from 10 to 15 per cent of the stalks were ruined. At Raleigh, in July, 1913, I found much injury by it in a garden, the worms even working in the tops which were bunched for tassel; in the stalks

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FIG. 6.—Work of the larger Corn Stalk-borer. *a*, appearance of young stalk badly injured. *b*, stalk cut open near root to show burrow and pupa inside.
(After Howard, Div. of Ent., U. S. Dept. Agr.)

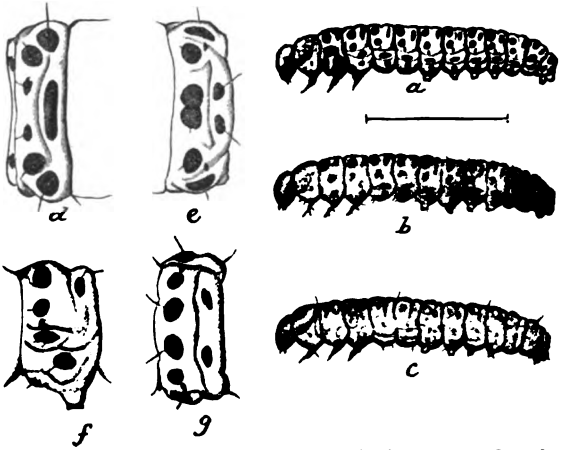

FIG. 7.—Showing larva of larger Corn Stalk-borer, *a*, *b* and *c* showing variations in the markings, etc. Natural length indicated by line below *a*. *d*, *e*, *f* and *g*, views of certain parts of body of larva.
(After Howard, Div. of Ent., U. S. Dept. Agr.)

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they were present above where the ear would be. As a rule, it works in the lower part of the stalk (especially later in the season) and often close to the ground. In Mecklenburg County it was reported as having destroyed a very serious per cent of the stalks in 1913.

Life-history.—As an enemy of corn, studies of this pest have been published by both Dr. L. O. Howard[1] and George C. Ainslie[2] of Washington, and by Prof. R. I. Smith,[3] formerly of the North Carolina Station. Two distinct broods are recognized. The winter is passed in the caterpillar stage below the ground level in the stalks or roots of corn, perhaps also in some other plants. In spring the caterpillars change to the pupa state, from which the adult moths emerge after about two weeks. These moths then lay eggs on the young corn and these hatch into the first destructive worms of the season, boring into the stalks and tops of the growing corn, their injuries becoming noticeable from June 10 to 20, at which time the worms are growing rapidly and

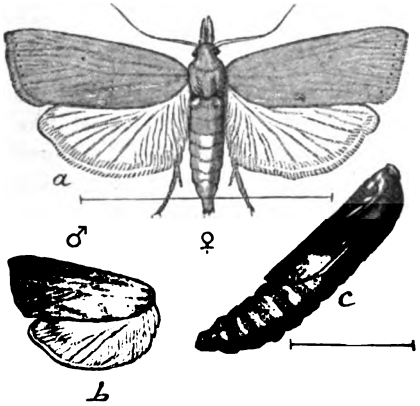

FIG. 8.—Pupa and adult of larger Corn Stalk-borer. *a*, adult moth. *b*, showing wings of male moth. *c*, pupa. Natural size of moth and pupa indicated by lines.
(After Howard, Div. of Ent., U. S. Dept. Agr.)

boring actively in the stalks. In Robeson County (1902) we found grown worms and others that had changed to pupæ on June 30th, and from these we reared adult moths July 8th. The first brood of moths, therefore, appeared that year to emerge first half of July, though two years later we received larvæ from Mecklenburg County on July 2d; so in the higher and cooler sections they are probably always somewhat later in reaching maturity. The second brood of worms burrow into the stalks chiefly in the first two joints above ground, and often so weaken them that they are blown to the ground. The worms of this second generation become grown by harvest, burrow down the center of the stalks

[1]Cir. 16, second series, Div. Ent., U. S. Dept. Agr., "Larger Corn Stalk-borer." L. O. Howard, Aug., 1896.
[2]Cir. 116, second series, Bur. Ent., U. S. Dept. Agr., "Larger Corn Stalk-borer." George N. Ainslie, Feb., 1910.
[3]Bul. 197, N. C. Exp. Sta., "Insects of Garden Crops." R. I. Smith, May, 1908, p. 35.

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to the root, and there pass the winter in the full-grown condition, changing to pupæ in the spring, from which the moths emerge to lay eggs for the destructive spring brood of worms.

It must be remembered that no exact dates can be set for the times at which moths will emerge, or eggs be laid, for these will vary with the season and elevation. Thus at Raleigh, in 1913, we found larvæ abundant in cornstalks July 1st, and in 1905 we found pupæ July 15th in stalks from Johnston County, though in 1902 we bred adult moths July 8th. But it seems fairly well established that normally there are two full broods each season. It is quite likely that some of the worms of the second brood feed on other plants than corn—indeed, in addition to corn and cane, Ainslie says that it has been reported on sorghum, Johnson grass, guinea-corn, and gama grass.

If each worm simply burrowed once into the stalks and remained inside, the case might not be so serious; but they have the destructive habit of leaving and reëntering the stalk again, so that each worm may make several holes.

REMEDIES.

Thorough destruction of stalks which have been rendered useless, remnants, and stubble, would seem to be the most likely method of control. If infested stalks be cut close to the ground while borers are still in them, and fed green, many of the borers will inevitably be destroyed. If the stalks are left standing until the usual time of harvest, and are then cut *close to the ground* and shredded or made into ensilage, it is to be presumed that some of the second brood will be destroyed. Those left in the stubble can then be reached by plowing out the stubble, raking together and burning. Through the early part of the season (up to about July 1st) stalks which have already been rendered worthless should be pulled and fed green as fast as they are seen to destroy the worms in them, for they have no future value anyway. Our common custom of "pulling" the fodder and allowing the stalks to stand is favorable to this insect. But if the fodder is to be "pulled," and it is desired to allow the stalks to rot in the field, then if they be plowed under as deeply as possible the adult moths would have difficulty in emerging.

Next to the destroying of the Borers themselves in the stalks, the later average planting seems to offer the best hope of escape. The data already given indicate that corn planted reasonably late will largely escape injury by the first brood, though it will be exposed to the second brood. Dr. Howard presents results noted in 1891 (in Virginia?), from which the following is given:

Date of Planting.	*Per Cent of Damaged Stalks.*
April 1 to 15	25
April 15 to 28	20
May 1 to 15	15
May 15 to 31	12
June 1 to 15	8, or less.

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Mr. Ainslie also recommends rotation as one of the best preventive measures, and says: "Where corn has followed itself on the same field for two or more years there has been a much greater loss than where a change of crop is practiced, especially where stalks and stubble remain undisturbed through winter." But he also says: "By far the most effective plan is to remove the stubble from the field with a rake and burn it."

The writer believes that this Stalk-borer offers a good chance for co-operative effort, for the moths are active fliers and can readily make their way from one field to another; hence it would seem that best results would be secured by all the farmers in a locality using the same methods at the same time.

THE CHINCH BUG. (*Blissus leucopterus*, Say.)

Order *Hemiptera*. Family *Lygæidæ*.

Description.—Small bugs about one-fifth inch long, blackish with white wings, the young bugs reddish. Appear at times in great numbers in wheat, oats, corn, millet, and timothy. There are both long-winged and short-winged forms. Most destructive in our piedmont section on "poor land." Primarily a dry-weather pest.

Injury in North Carolina.—This insect is very irregular in its appearance as a pest. It is present every year, but only at irregular intervals does it become excessively abundant. Any pest of this character is sure to be often reported when it does appear in numbers, especially by those of the younger generation of farmers who have not become indifferent to its ravages. Farmers who have lived long in the region of Chinch-bug injury well know of their destructiveness; others may take our statement for it that when conditions favor their increase they appear by millions, sucking the sap from the plants until they dry up as if from drought or fire. At such times the destruction is often complete, every stalk being sucked to death (not eaten) by the insects. From our somewhat voluminous correspondence we quote the following as typical and enlightening:

"They came from my wheat-field and are sucking my corn to death; have covered 2 or 3 acres in ten days." (Later) "They are not doing very much while the heavy rains fall."

"I think they first appeared in oats, then destroyed sorghum-cane, now in the corn and are destroying it. They get around the stalk near the ground and on the blades and suck it to death; seem to move in a solid army. Paris-green will not kill them."

"After harvest the bugs came from the adjoining wheat-field, marched into my corn and sucked it until it died or was so dwarfed (next the wheat) that no ears could form."

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"Since the wheat was cut they have gone into the corn. They cover the stalk around the roots and in a few days the stalks will die."

"They gather at the root of the corn (or) under the sheath of the blade and there suck until they ruin the whole stalk."

"They sometimes ruin our corn on the clay land. If I had a remedy would prefer to plant corn on the clay and cotton on the sandy land."

In May, 1905, a correspondent in Rockingham County wrote that he had suffered destruction to timothy by Chinch Bugs for four years in succession; but we are forced to believe that this was a very unusual experience, at least for this State.

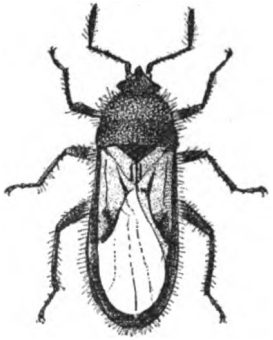

FIG. 9.—Adult Chinch Bug, showing dark color of body and white wings. Much enlarged. Insect in reality about one-fifth inch in length. This is the long-winged form of the insect.

(After Webster, Div. Ent., U. S. Dept. Agr.)

DISTRIBUTION, HABITS, LIFE-HISTORY.[1]

Distribution.—The Chinch Bug occurs throughout the United States east of New Mexico, Wyoming, and North Dakota (including parts of those States); also in southern and eastern Canada, eastern Mexico, in Central America and Panama; also in areas in California. It seemingly is absent in southern Florida, and occurs sparingly if at all in the higher Alleghany Mountains (statement made from Webster's Map). The area in which it is to be regarded as a pest is more restricted, embracing a large territory in what we term the "central west" (including Kansas, Iowa, Missouri, Illinois, etc.). There are spots of severe infection in Maine, New York, Tennessee, and Louisiana. But what is of

[1]Among the writings on Chinch Bug, we may mention Bul. 95, Ill. Exp. Sta., by S. A. Forbes; "The 1912 Chinch Bug Campaign in Illinois," by S. A. Forbes; Bul. 69, Bur. Ent., U. S. Dept. Agr., by F. M. Webster; Cir. 113, Bur. Ent., U. S. Dept. Agr., by F. M. Webster; Bul. 191, Kan. Exp. Sta., by T. J. Headlee and J. W. McCulloch.

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most concern to North Carolina farmers is the fact that a belt of badly infested territory begins in central Virginia, extends entirely across the piedmont area of North Carolina, and terminates in South Carolina. (Webster's Map).

This indication by Professor Webster is in accord with the ravages reported in North Carolina. The only strictly eastern counties from which we have had complaints are Pamlico and Gates; but in the piedmont section complaints have been numerous from Warren to Stokes counties on the north, southward to and including the counties of Wake, Lee, and Anson in the east, and Rowan, Iredell, and Gaston on the west, thus including the greater part of our "piedmont" area. The writer has, however, *collected* specimens of the bug at Beaufort on the coast; but it has not been reported as a pest there.

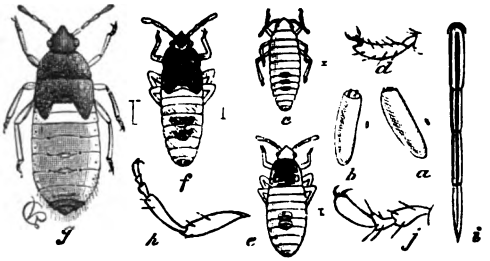

FIG. 10.—Showing various stages in growth of Chinch Bug. *a* and *b*, eggs. *c*, *e*, *f* and *g*, stages in growth of young bugs. *d*, *h* and *j*, legs. *i*, sucking beak through which the insect sucks sap from the plant. All enlarged, natural sizes indicated by lines, etc., at side of figures.

(After Riley, Div. Ent., U. S. Dept. Agr.)

Habits and Life-history.—Adult bugs pass the winter in grasses, under rubbish, etc. At Raleigh we have found them in winter under boards at grassy edges of fields. When spring opens these bugs take flight early and seek growing grasses or small grains which will serve as food. In 1905 (while inspecting wheat-fields for Hessian Fly with Professor Webster), it was found April 11 in Guilford County at base of wheat plants. We did not find eggs nor observe mating. On April 14 (1905) Professor Webster found one adult in wheat-field in Mecklenburg County. My notes of that trip say: "Farmers say they appear worse in spots near stumps, stones, and trash, in which, no doubt, they hibernate. Stones and trash were near where these were found." The adults which emerge in spring fly freely in search of suitable food.

Once settled in the fields of small grain (or grass), they finally lay eggs, and the young bugs which hatch feed on the growing plants. The young bug bears a general resemblance to the adult, though it is reddish and wingless (there is no worm, larva, or caterpillar stage in the

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Chinch Bug). About the time of harvesting wheat and oats these young bugs mature, and they then spread to cornfields for new food, doing so mostly by *walking or crawling* instead of flying, though they have wings. Another brood of young then develop in the corn, and these, when winter approaches, seek winter quarters. There are, so far as positively known, only two complete and distinct broods, the first maturing in the small grain and the second in the corn. This fact of two distinct broods and the habit of migrating is clearly indicated in the letters of complaint which we have already quoted. But it is worthy of special emphasis that *in going from the wheat or oats to the corn, they do so chiefly by crawling* (*not flying*), for on this point the protection of the corn from the bugs largely depends.

The Chinch Bug, both in young and adult, is provided with a beak attached to the head, which is thrust into the plant and through which the juices are sucked. Being thus a sap feeder, it cannot be poisoned by Paris-green, etc., which must remain only on the surface of the plant. The effect of their attack is to dry out and wilt down the plant.

There are two forms, or races, of the Chinch Bug: one having wings nearly as long as the body when adult, the other having decidedly shorter wings when adult. It is said that the short-winged form is more prone to attack grasses; while it is the long-winged form that is the chief enemy to corn.[1] All the adult bugs in our collection are of the long-winged form.

Dry Weather Favors Chinch Bugs.—Usually Chinch Bugs are more destructive in dry weather, and in wet seasons they are not so noticeable. This is apparently because of certain epidemics of disease among them which are more virulent during wet seasons. It is well for farmers to know this, as it is often convenient to be able to forecast, even though imperfectly, their probable appearance in any locality in destructive numbers. Heavy showers also drown many of them.

Worse on Certain Lands.—A preference for clay lands rather than sandy is indicated in the complaints already quoted, and the same or similar testimony is often offered to the writer when discussing this insect at Farmers' Institutes. We have also been assured at Institutes (humorously but seriously) that there is no better preventive for them than stable manure, as they are sure to be most destructive on the "thin, poor spots in the field," and that the farmer on thin, poor land suffers worse from them than the one on rich, strong land. In any event, we can all agree that the more vigorous and healthy the corn, the more resistant it will be to slight injuries, whether from this or any other insect.

Natural Enemies.—On account of a very disagreeable odor possessed by these insects, one would not expect to find many enemies which

[1]Cases similar to this are known in other insects. Certain grasshoppers which inhabit densely grassy places are short-winged and cannot fly, while closely related species occurring in the open have longer wings and can fly.

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would devour them. Although a large number of birds doubtless eat them to a greater or less extent, the quail or common "Bobwhite" stands at the head of the list, and the blackbirds, bobolinks and sparrows follow.

But by far the most prevalent natural enemies of the Chinch Bug are certain diseases, particularly those of a fungous nature, which not infrequently save many thousands of dollars to the farmers by destroying the bugs. One of these fungous diseases, known as the Muscardine fungus, has been considerably experimented with in Kansas and some other states, to see if it could not be artificially introduced into fields where the bugs were doing injury; but it is so slow to get started, and so uncertain in its results, that it has never come into general use.

REMEDIES.

Out of all the mass of recommendations for the control of chinch bugs, three methods stand out as available and useful as conditions exist in this State: (1) Destruction of the bugs in their winter quarters; (2) preventing them from spreading from wheat or oats to corn by means of barriers to their progress, and (3) killing them (the young ones, at least) by spraying while they are in restricted areas, before they have spread throughout the cornfield.

Destruction of Bugs in Winter.—In Kansas, where the bugs seem to hibernate largely in bunch-grass, they have been successfully destroyed by burning over *closely* so as to reach those that are close down between the bases of the stems. In North Carolina we at present know of no one place in which the bugs especially congregate for winter, but have found them under rubbish in grassy places near cornfields. Hence the cleaning and burning over of such waste places, fence-rows, ditch-banks, etc., adjacent to cornfields which were infested in summer will seem likely to destroy many of the over-wintering bugs. But as the bugs are not usually serious with us two years in succession, farmers may neglect this after-measure, and may be more inclined to depend on the next method discussed, namely:

Preventing the Spread into Corn, by Barriers.—For this purpose, a deep furrow, a strip of plowed and finely pulverized soil, a narrow strip of tar laid in a furrow or even simply on the ground—these all serve to check the insects in their march from one field to another. If a furrow is to be used it should be deep and so run that the earth shall be thrown toward where the bugs are already congregated, so that they will have to *climb* the *steep side* of the furrow. If the insects are found in the oat stubble, for example, one or two such furrows should at once be plowed around the field to prevent their escape. Two furrows a few feet apart will of course be more effective than one.

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The furrow may be made still more effective by digging holes with regular post-hole digger every 15 to 20 feet in the bottom of the furrow. The bugs falling in the furrow will run along trying to find an outlet, and presently falling in the holes, will be quite unable to escape.[1]

Infested stubble can be burned over, if thick and dry enough, or plowed deeply and rolled or dragged to finely pulverize the surface.

If a strip several yards wide be plowed *around* the infested oats or wheat and this be finely pulverized, the bugs will have difficulty in crossing it so long as the surface remains dry and dusty; rain will hinder its usefulness.

The use of a strip or line of tar around a field serves the same general purpose.[2] Two such strips a yard or two apart will be even more effective. The earth may be scraped clean along the line where the tar is to be placed, so that sticks, grass or weeds shall not serve as bridges for the insects to cross.

Where a part of the cornfield has become infested, the same methods may be employed, separating the infested from the uninfested parts of the field, so as to check their advance.

Of course, the best protection will be secured by the employment of several of these methods together.

The success of these methods is based upon the fact that the adults which mature in June *crawl* rather than *fly*, even though they do have wings. And as their legs are short and their bodies comparatively inelastic, they find it difficult to overcome obstacles such as have been mentioned; furrows, strips of tar, or finely pulverized soil making very effectual barriers to their progress. Of course, a sudden dash of rain may destroy the barriers, which must be replaced at once.

Spraying.—We are not advocating the spraying of whole cornfields to protect them from Chinch Bug. This spraying method is available chiefly while the bugs are only in restricted areas of the corn.

Kerosene emulsion has been recommended for this purpose by Professor Webster (1907), to be prepared as follows: Dissolve ½ lb. of hard soap in 1 gal. water, bring to a boil, then pour in 2 gals. kerosene and churn together vigorously until it becomes cream-like. To each gallon of this add 15 gallons of water, mixing thoroughly. He states that it is best to spray the corn with this before 8 a. m. or after 5 p. m., as it will then be less likely to hurt the plants.

But in the writer's personal experience with plant-lice he finds that ordinary grades of laundry soap dissolved in warm water is an excellent substitute for the more complicated (and more dangerous to plants) oil

[1]Headlee and McColloch, in Kansas, found a blast-torch preferable for destroying the bugs along the barrier.

[2]In Illinois, Dr. Forbes had excellent results from "Road Oil No. 7," a grade costing about $3.50 per barrel and especially prepared for Chinch Bug work. (Standard Oil Refinery, Whiting, Ind.) In this State tar would perhaps be more available.

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emulsion. And Dr. Forbes in his Chinch Bug work in 1912 found that, "Chinch Bugs were killed by the soap solution alone, with no injury to the corn, if cheap rosin soaps were used at the rate of 1 lb. to 6 gals. water."

In this State such brands as "Octagon," "New Home," and the like are everywhere in common household use, and we have controlled many plant-lice by using these brands dissolved in water at rate of 1 lb. to 4 gals. Hence we give the method by which we have prepared it, believing (without actual test against this particular pest) that it will be quite satisfactory against young Chinch Bugs:

Cut 1 lb. of soap into thin slices in 2 gals. water. Bring to boil to dissolve the soap; now pour in 2 gals. water (cold preferably), and spray while the solution is still warm.

If the cheaper grades of "rosin soap" are on hand, they may be used in same way, or, as suggested by Dr. Forbes, even at the weaker strength of 1 lb. to 6 gals. In spraying for Chinch Bugs use liberally enough to thoroughly *drench* them.

In closing this discussion of the remedial measures for the Chinch Bug, it is of interest to read the following letter from one who used the furrow method. This letter is here given because there are so many who believe that such a remedy will not prove satisfactory:

* * * Will say that I first had deep furrows, throwing the dirt from the corn and then bedded back to the corn. In this way the bugs were held in check, and destroyed only ten or twelve rows that they first appeared in. Thanking you for your prompt reply, I am,

Very truly, W. N. BOYD.

Warrenton, Warren County, N. C., October 19, 1904.

ARMY WORMS—TWO KINDS.

Order *Lepidoptera*. Family *Noctuidæ*.

There are two distinct, though closely related, species of corn insects which when abundant are commonly called "Army-worms." The adults of both are moths and they belong to the same family (*Noctuidæ*), which family also contains the cut-worm and ear-worm moths, discussed in this BULLETIN.

As the life-histories of these two insects differ, we discuss each separately. The one which normally is destructive earlier in the season is the true "Army-worm"; the other which is destructive later is distinguished by the name of the "Fall Army-worm."

THE ARMY-WORM. (*Heliophila unipuncta*, Haw.)

Description.—The grown caterpillars are about 1½ inches long, of a dark gray or blackish color with three narrow yellowish stripes above

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and a darker and broader one on each side, appearing at times in hordes of countless thousands, devouring vegetation of various kinds, but especially grains and grasses. The adult moths spread about 1½ inches from tip to tip of the wings and are brownish-yellow in color.

FIG. 11.—Army-worm (larva) on head of timothy. Natural size. (After Comstock, Div. Ent., U. S. Dept. Agr.)

Injury in North Carolina.—Very few outbreaks of this insect have been reported to us, although it is certainly present in at least limited numbers every year. Adult moths are often found at Raleigh from May to November. We have one adult moth captured by the writer at Hendersonville in June, 1907. The indications are that it occurs throughout the State, but that its area of destructiveness is chiefly in the western half.

In 1907, three complaints of damage by it were received from the mountains, but in no case was the outbreak reported as widespread. The complaints were all in May.

In August, 1908, while the writer was in the western part of the State on Institute work, news of an "Army-worm" outbreak came from Durham, N. C., and this was looked into by Assistant Z. P. Metcalf, some of whose observations will be presented later in this account.

Life-history, Habits, etc.—There are undoubtedly several broods of this insect each year, for at Raleigh the moths have been collected from May to November by Mr.

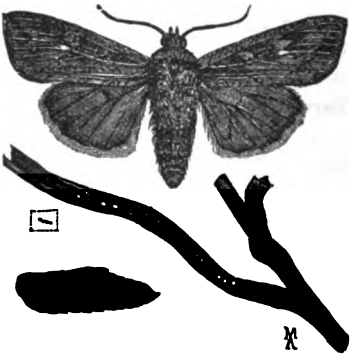

FIG. 12.—Army-worm moth, pupa and eggs on grass stem. Natural size. (After Comstock, Div. Ent., U. S. Dept. Agr.)

C. S. Brimley. Dr. Forbes[1] states that only one brood is apt to be destructive in any one locality in any one year. This agrees with the reports which have come to us; and observations in 1908 indicate that there is a good reason. It is believed that the winter is spent in the

[1]An excellent account which I have consulted in this connection is given by Dr. S. A. Forbes in Bul. 95, Ill. Exp. Sta. Some of the statements are also based on a Bulletin of the N. Y. (Cornell) Exp. Sta., by M. V. Slingerland.

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adult moth state, the moths laying eggs in early spring in grassy places, each female moth being capable of laying several hundred eggs. The worms which hatch from these feed on grasses, and when the supply is exhausted may march in an "army" into corn or other grain. They feed eagerly, grow rapidly, and finally enter the earth to change to the pupa stage, from which adult moths emerge in two weeks, and these, after mating, lay eggs for another brood.

When searching for new food they often move in a solid army containing countless thousands of individual worms, and devour all suitable food as they go. The records that we have for this State indicate that they have destroyed corn, grasses, and timothy; but wheat, oats, millet, etc., are also relished. Their preference seems to be for the grass-like plants; but in absence of these, they may be induced by hunger to take others.

Natural Enemies.—Fortunately, this Army-worm seems especially susceptible to subjection by its natural enemies, among which the most important seems to be a parasitic fly (*Winthemia 4-pustulata,* Fab. Order *Diptera*). This fly is somewhat larger than a house-fly and more bristly. It lays its eggs on the skin of the Army-worm and the fly-maggots hatching from these eggs eat into the body of the worm, usually causing its death before it can reach the adult moth stage to perpetuate another brood.

Mr. Z. P. Metcalf, at that time assistant in this office, made observations on the activity and efficiency of these parasites during the Army-worm outbreak at Durham in August, 1908. Out of 491 worms which Mr. Metcalf brought back and confined in cages, 442 were infested with eggs of this parasite, leaving 49 without parasites,—yet 61 of the worms developed to the pupa, but only 7 yielded adult moths. In a few cases he found that where only a single egg had been fastened to the worm, that it was able to complete its changes and emerge as an adult moth. But the fact of only 7 moths developing from 491 worms indicates that over 98 per cent of the worms died before reaching maturity, while from these same 491 worms he reared 556 adults of the fly-parasite. His data showed that while many of the parasites also died before they matured, that the *rate of mortality* with the Army-worm was over 98 per cent, while for the parasite it was 73 per cent. This difference would undoubtedly be much greater could the rate have been calculated from *egg to adult* in both cases; but this was impossible. But these results show that the tendency would be for the flies to rapidly overtake the worms in number, and subdue them; and this, no doubt, in large measure explains why the Army-worm is not more often destructive, and why it is that usually only one destructive brood shows up in a locality in any one season.

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REMEDIES.

The remedies for this Army-worm are much the same as for the Fall Army-worm next discussed, hence will be considered in that connection. (See page 40.)

THE FALL ARMY-WORM. (*Laphygma frugiperda*, S. & A.)

Description.—Grown caterpillars are from 1 inch to 1½ inches long; along each side a black stripe and in middle a wider yellow-gray stripe which includes four black dots on each body segment. Sometimes occurring in great numbers together, in late summer, though often more scattering; feed on great variety of plants. The adult moth spreads about 1 inch from tip to tip, front wings mottled grayish-brown, hind wings pinkish white, almost transparent.

Injury in North Carolina.—In 1899 (before the writer was engaged in work in the State) this species was destructive in the southeastern part, being reported to the U. S. Department of Agriculture from several localities.

In 1902 (August 23) it was reported from Duplin County, and as the letter well illustrates the work of the species, we quote:

"Crab-grass came up all between the peas and the outlook for a fine crop of hay was very good, but two or three weeks ago a small striped worm appeared and has literally stripped the grass, leaving stems only; are beginning to cut the peas; they are here by millions."

But during the present century, at least, there has been no year in which the area and severity of its ravages could compare with that of 1912, when it was indeed a severe scourge in many localities in our State.

Outbreak of 1912.—The first positive report of Fall Army-worm in 1912 came July 20, from Chadbourn, Columbus County, where it was reported as eating young corn. The last complaint was October 26, from Pilot Mountain, Surry County, where it was attacking rye. The complaints were, however, divided approximately into three series, which we believe did actually indicate three successive destructive broods of the worms. The first series of complaints covered the period from July 20 to August 3. The second series began August 17 and ended August 26. The third series of complaints opened September 25 and closed October 26. There were no complaints *dated* between August 3 and 17, nor between August 26 and September 25. The last series contained only three complaints (September 25, 27, and October 25), of which the last might possibly represent a fourth destructive generation of worms, though probably not.

Many of the complaints indicated no particular crop, but among the crops which were definitely reported as suffering were corn, grass, soy

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beans, peanuts, peas, alfalfa, rye, cane, potatoes (kind not specified), and cotton. But the cotton farmer who reads this account should bear in mind that this Fall Army-worm is *not the same* as the cotton caterpillar which stripped cotton throughout the Sate in 1911.

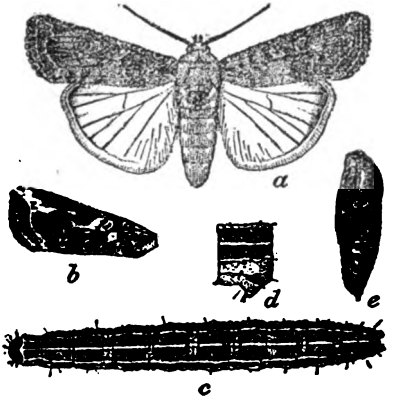

FIG. 13.—Fall Army-worm. *a*, adult moth; *b*, wing, showing variation in markings; *c*, larva or "Fall Army-worm"; *d*, part of body of worm, from side; *e*, pupa.
d is twice natural size; others one-fourth larger than natural size.
(After Chittenden, Bur. Ent., U. S. Dept. Agr.)

While the injury and complaint regarding Fall Army-worm was especially severe in 1912, it is interesting to know that the insect is really common with us every year, though only occasionally do the caterpillars appear in such destructive hordes. Thus, in 1906 we have undoubted evidence that the insect was abundant, though no complaint of it reached us. In that year Mr. C. S. Brimley of Raleigh, an insect collector, was collecting moths by attracting them to trees on which a sugar mixture had been smeared. He noted that the adult moths of this Fall Army-worm were very abundant, counting "about 600 of these moths on five sugared trees on August 23, and they were present in same numbers the next two nights. The same five trees were visited by about 300 moths on the night of October 3." Mr. Brimley records the occurrence of the moths at Raleigh from late July to early November.[1] These observations and notes were made and published by Mr. Brimley over three years before the outbreak of 1912. I present this data here as proof to our farmers that the severe outbreak of 1912 was not by a "new insect," but by one which is present every year, and similar outbreaks may occur any year when conditions are suited to the insect. Yet the moths are free fliers and may wander or migrate for some distance before laying eggs, so that a brood of worms in one locality may yield moths which will produce another brood of worms in some other locality. Study of the distribution of complaints received in 1912, in connection with the dates, might indicate this, but we will not take the space.

[1]Entomological News, Jan., 1909, p. 35.

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Life-history.—Briefly put, the life-history seems to be about as follows: The winter is believed to be passed mainly in the pupa stage an inch or two below the surface of the ground. Moths emerging from these in spring or early summer lay eggs from which a brood of worms hatch. These, when grown, go underground and change to pupæ, from which another brood of moths emerges later. How many distinct broods may thus be produced we do not know, but as the worms feed ravenously and grow rapidly, there are certainly several broods, the later broods (July to October—our records) being more likely to be destructive.

REMEDIES.

The outbreak of 1912 extended through many of the southern states and called forth a special appropriation and special investigation by the U. S. Department of Agriculture. In August, 1912, the U. S. Department issued Circular No. 40 (revised), upon which this account of remedies is based.

Poisoning the Worms.—In making applications of poison to kill the worms, it must be remembered that the vegetation which is so treated is not to be used as forage. Hence this method is more applicable to waste places, or in the edges of cornfields rather than wholesale over entire forage crops. Paris-green or arsenate of lead may be used, either as a dust application or in water as a spray. As Paris-green is better known and more available, we discuss it first, although the arsenate is considered to be really more effective.

Paris-green, Dry.—Mix Paris-green with lime or flour at rate of 1 lb. to 4 lbs. of lime or flour. The worms eat it more readily if mixed with flour, but it is less likely to hurt leaves if mixed with lime. Take your choice. Dust the plants until whitened.

Paris-green, Spray.—Mix Paris-green with water at rate of 10 ounces to 50 gallons, adding 2 lbs. of freshly slaked lime. Spray liberally, endeavoring to reach all the leaves or blades of the plants treated.

Arsenate of Lead, Dry.—This material is more commonly sold in paste form, but the dry powdered form can be ordered, and is considered better than Paris-green because it can be dusted on pure without injury to the leaves. It will be cheaper to mix it with equal or twice its weight of flour.

Arsenate of Lead, Spray.—If the powdered form is to be used as a spray, mix with water at rate of 2 lbs. to 50 gals. water. If the paste form is to be used, use 4 lbs. to 50 gals. water; spray thoroughly.

Poison Bait.—This method gives a chance to poison the worms without applying it to plants at all, so the plants can be used as forage afterwards. Mix 2 to 3 lbs. of either Paris-green or (powdered) arsenate of lead with 100 lbs. wheat bran. Add 2 gals. syrup, and water enough to moisten; mix thoroughly, and distribute on ground where worms are.

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Barriers.—If a deep furrow be plowed ahead of the moving worms, or around fields to be protected, or around the area where the worms are, so as to confine them, they find it somewhat difficult to cross the obstruction. In all cases list *toward* the worms, so they will have to climb the *steep side* of the furrow. If it is desirable or seems necessary to destroy them as they gather in the furrow, a log may be dragged along in the furrow from time to time, or they may be killed by application of kerosene or a blast-torch, or occasional post-holes in bottom of the furrow will concentrate many where they may be crushed.

Cultivation.—As the worms go underground only an inch or so to change to the pupa stage, many of them may be killed or at least disturbed in this process by thorough shallow cultivation, or disking the land where a brood of worms *has matured and just disappeared.* This would need to be done soon after the worms enter the earth, for in the course of a week or two they will have issued as moths, and then the work would be absolutely useless.

When Army-worms have developed in large number, and especially when they begin to move from one field to another, they require immediate and thorough action. It may require the labor of every available hand for a day or two to keep them in check; but fortunately the duration of each brood is short, and much depends upon detecting the trouble *early* before the worms are widespread, and taking prompt action *then.* While we have discussed the remedies for both kinds together, it is to be remembered that there are two distinct Army-worms which may attack corn, the "Army-worm" being more in the western part of the State, more confined to grasses and grains, and more apt to remain in dense "armies." The Fall Army-worm is more prevalent (according to present evidence) in the eastern and southern parts of the State, feeds on a greater variety of crops, and is more inclined to scatter instead of remaining in compact swarms.

THE SUGAR-CANE BEETLE. (*Ligyrus rugiceps*, Lec.)

Order *Coleoptera.* Family *Scarabæidæ.*

Description.—A pitch-black beetle about one-half inch long, of somewhat the shape of our green "June Bug"; attacking corn at or about the surface of the ground, eating into the stalks.

Injury in North Carolina.—Records of the U. S. Department of Agriculture at Washington show that in June, 1885, this insect was reported from Monroe, Union County, with the statement that it was new to the farmers there.

On May 30, 1904, Dr. E. S. Credle, Pantego, Beaufort County, made complaint of this pest. As our correspondence at that time covered most of what is (even now) known of the insect in this State, it is given in some detail. His first letter was as follows:

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I send you under separate cover a bottle of bugs that are destroying the corn crop in this township. Please let me know what they are and if there is any remedy for them.

REPLY.

* * * It is the Sugar-cane Beetle, which is regularly destructive in Louisiana, but of which I have never had any complaint during the four years I have been in this State. As its name indicates, it is known primarily as a pest of the sugar-cane. * * * A most careful search of the literature fails to reveal any reference to remedies which have been found effectual, and I guess we must put it among those (pests) against which we have little or no means of defense. It has been suggested that the beetles are attracted to lights, and I would suggest that you hang a brightly burning lantern in your cornfield suspended over a pan in which is tar, or water and kerosene.

* * * Now this will be an experiment merely. I am not even sure that it will attract a single one of the insects, but I think that the test will be well worth making. * * * Please also try to give me some information on the following points: (1) How many years have you known this pest? (2) How long has it been with you this season? (3) Where and how does it attack the plant (living specimens with plant would furnish best answer)? (4) How abundant is it in the fields—how many at each hill on an average?

* * * Any observations that you can make, or specimens that you can obtain, bearing on the life-history or habits of the insect will be of interest and value. (June 4, 1904.)

Dr. Credle's next letter was dated June 9, 1904, and was as follows:

* * * I have tried the lantern and water and kerosene, also the tar, but had no success; did not get a dozen bugs in three nights. These bugs first appeared here last year about the middle of May, and after the first big rain we had they disappeared. They returned this season, first of April, and are here yet and very numerous, from eight to ten to the hill of corn. I send you, under separate cover, bugs with a sample of the different sizes of corn and cotton that they are at work on. * * * You will notice they do their work right at the root, and they can kill corn any size. The outlook is that they are going to be the most destructive pest that we have ever had. Hope there may be some way to destroy them.

REPLY.

* * * I would like to make a few other suggestions as to remedies, and if you find it convenient to try them I hope you will report results: (1) the sprinkling of a little wood-ashes about the base of the plants, say a handful to each hill; (2) same, using air-slacked lime; (3) pine sawdust, which should be fresh enough to have a strong tar or pitch odor. If you try any of these methods I would advise that you use them only on a small scale, as it will likely prove useless in any case, and it would scarcely be advisable for you to go to any great trouble in a mere experiment. (June 11, 1904.)

Dr. Credle's next letter is dated June 14, 1904, and from it the following is taken:

* * * I am still of the impression that they are dry-weather bugs. The part of the township (where) they are doing the worst damage there has been no rain since March. There has not been enough rain since the first

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of April to lay the dust, but I have noticed for the last few days they (the bugs) are dying; can see them all about in the field dead. Will try the remedies you suggest and report.

On June 6, 1905 (a year later), Dr. Credle wrote:

* * * My corn crop last year was so completely destroyed by the beetles that I had what was left plowed up the first of June and planted over on the 7th and 8th. This last crop was not bothered in the least by them, and I made a good crop. They have been there all winter. When the corn was being housed in December we would often find them under the shuck, eating the corn. * * * They have destroyed corn for me this season, but not so bad as last. The only places they bothered this year to any amount was where I raised hay last year. But they have stopped now, and I don't think they will bother further this season. Several of my neighbors have had to plow up and plant over this season, that were bothered very little last year. I did not use any of the remedies, as I did not have any cause to do so in the last planting. Did not make any observation on the egg-laying habits, but as they seem to bother more where that old dead grass was plowed in, that must have been the place where they laid (very likely!). I am satisfied that they do but little damage after June 1st.

Dr. Credle also stated that the insects seemed very fond of irish potatoes, and that while breaking ground they often found them eating the volunteer potatoes in the spring.

Mr. J. P. Clark, of Pantego, also wrote (June 2) in 1905, stating that farmers were again troubled with this Cane-beetle; that some of the land had to be plowed and replanted.

This time we were able to make some observations in the field. Mr. G. M. Bentley (at that time assistant) was sent to Pantego to examine the conditions. His observations are dated June 14, 1905. The first field examined had been much damaged and replanted, the corn then being nearly 6 feet high; only a few of the beetles were found, and injury was not much in evidence. In the second field the corn had been planted for the third time of the season and was smaller; a considerable number of the beetles were found eating the young stalks. The third field examined was that of Dr. Credle, from whom we have already quoted. A number of beetles were found (after careful search), as many as five on one stalk, working at, or just beneath, the surface of the ground. Observations in different parts of the field showed that "noticeably more beetles were at work in a certain portion of the field where 'bull-grass' had been plowed in. The beetles were found mating in several instances." Specimens sent by Dr. Credle, June 9, 1904, were mating in box when received.

Since the outbreak of 1904 and 1905 in Beaufort County we have had only one complaint, this coming in June, 1912, from Greenville, Pitt County; but there was no indication that the damage was widespread or long continued.

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DISCUSSION OF THE INSECT.[1]

FIG. 14.—Sugar-cane Beetles. A row of the adult insects, natural size. See also figure on front cover of this Bulletin (original).

The complete life-history of this insect does not appear to be known, the laying of the eggs, appearance of grown larvæ, and methods of pupation, all being unsettled points. Most of the observations that have been made on the insect have been made in Louisiana and Mississippi, and here the habits and life-history might be slightly different. If the larva lives on the roots of the sugar-cane in Louisiana, it may live on roots of grasses, as Dr. Credle intimates, or sorghum-cane, some species of wild reed or rush, or perhaps on corn itself, in this State. As to its being primarily a dry-weather insect, as intimated by Dr. Credle, the natural habitat of the insect in the low cane-lands of Louisiana would seem to show that if anything it should prefer a damp climate. Observations made in Mississippi seemed to show it to be worse in wet lands, and this would seem to be a natural occurrence. In June, 1886, Mr. G. W. Smith-Vaniz, of Canton, Miss., in writing to the U. S. Department of Agriculture at Washington, sent eggs found in soil near corn where the beetles were at work, and which were similar to eggs dissected from the bodies of female beetles. Mr. Smith-Vaniz also hatched out young larvæ; but there the observations seem to cease.

We have in our collection one specimen of the adult beetle which was taken at Gastonia, Gaston County, on May 30, 1902.

As to the possibilities of this insect becoming a regular and serious corn pest in this State, it seems reasonable to infer that its injuries will probably be confined chiefly to the eastern part of the State, in what is commonly known as the coastal region, and its outbreaks, however serious at times, will probably be of irregular and infrequent occurrence. How long it has already been in the State no one can tell with certainty. The injury to cotton and potatoes, as reported by Dr. Credle, is probably unusual and occurs only when the beetles are exceedingly abundant.

REMEDIES.

Late planting, liberal fertilization, and cultivation are the only palliatives that we can suggest which are at all certain to yield results. It is

[1]An article on this insect from which this account is largely drawn (other than our own notes and observations) was published by Dr. L. O. Howard, U. S. Entomologist, in Insect Life, Vol. 1, pp. 11-13, 1889.

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to be observed that corn planted June 7th and 8th, 1904, made a good crop at Pantego, and in 1905 the insects were disappearing as early as June 6th. Dr. Credle's observation of their being worse on land just from grass suggests the advisability of avoiding such lands for corn.

Although the insects seem to be attracted to lights at times, this habit does not seem to tempt them to leave the plants when feeding and cannot be relied upon to lure them to their destruction.

See Rotation (p. 6), Fertilization (p. 7), Time of Planting (p. 7), Cultivation (p. 8).

THE CORN EAR-WORM. (*Heliothis armigera*, Hub.)

Order *Lepidoptera*. Family *Noctuidæ*.

Description.—A grayish, greenish, reddish or brownish caterpillar (very variable in color), about one and a quarter inches long when grown, which eats into the ears of corn, often several in a single ear. The adult is a yellowish-brown moth with wings expanding from 1 to 1¼ inches from tip to tip.

Injury in North Carolina.—Among our destructive insects we think that this stands near the head, both in the total amount of damage done and the difficulty of combating it. According as it attacks different parts of the several crops, it is known as the Cotton Boll-worm, the Tobacco Bud-worm, the Tomato Fruit-worm, the Corn "Shatter-worm" (when in the top of corn) and the Corn Ear-worm. The insect also attacks other plants to more or less extent; has been reported burrowing in the pods of cow-peas, in the seed-pods of tobacco, and others have recorded it as occasionally eating into orchard fruits, though we have not noted this. Here we are principally concerned with its injuries to corn, and in this connection the following records are of interest:

In the latter part of May and early June, 1902, complaints were received from Mr. A. T. McCallum at Red Springs and Mr. A. J. McKimmon of Maxton, both in Robeson County. In response to these complaints the writer made a visit, giving special attention to the case at Maxton, which was especially serious. Mr. McKimmon had about thirty acres planted in sweet corn for shipment to northern markets, but scarcely an ear could be found which was not infested with *several* of these larvæ. As many as eleven were found in a single ear. The crop was fully 75 per cent (if not 99 per cent) lost from the ravages of this pest.

Early in January, 1903, Mr. R. W. Livermore, also of Red Springs, wrote asking about methods of combating this pest which had done him serious injury the year previous. From his letters, dated January 6th and 8th:

* * * The worm which was doing the damage in my early corn last year was the worm which bores into the ear when the corn is ripening. I am inclined to think that this worm shuts out the early sweet-corn crop for this section as a shipping crop to be depended upon.

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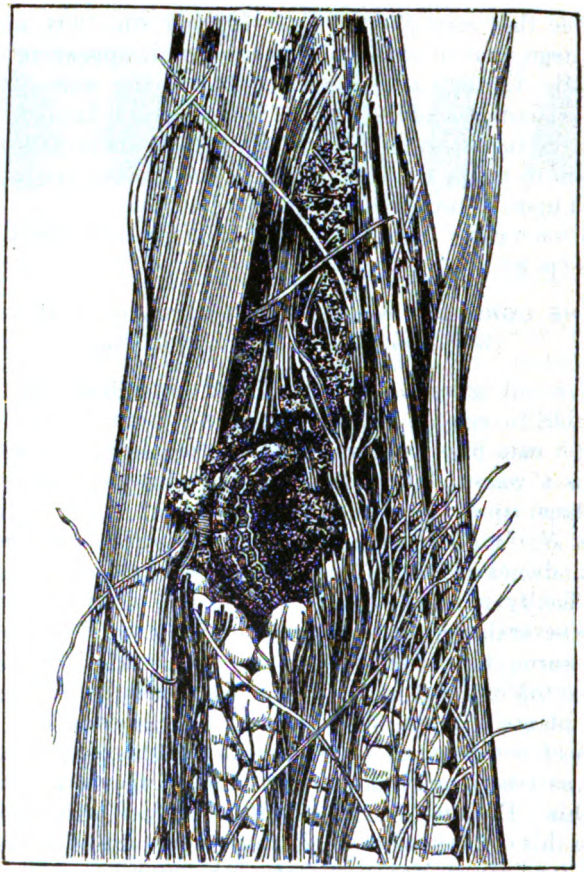

FIG. 15.—The Corn Ear-worm, showing the destructive larva at work in ear of corn.
(After Quaintance, Bureau Ent., U. S. Dept. Agr.)

Life-history and Habits.[1]—The winter is passed in the pupa stage, under the surface of the ground. The adult moths come out in spring or early summer and, being very active fliers, wander whither they will in search of nectar-bearing flowers or suitable plants upon which to place the eggs. When corn is the object of attack the eggs are laid on the silk, though the early brood of moths often deposit them in the terminal growing part of the plant, in which case the caterpillars eat the leaves and tassel and are called "Shatter-worms." The great majority of the eggs are laid on the silk, and the larvæ work down the silk, or bore directly through the husk to the forming ear, where they feed on the kernels and soon attain full growth, when they burrow out

[1]This portion of the account is based partially on Farmers' Bul. 191, U. S. Dept. Agr., by A. L. Quaintance.

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FIG. 16.—The Corn Ear-worm, showing larva at work on blades of corn. When it does this injury it is sometimes known as the "Shatter-worm."

(After Quaintance, Bureau Ent., U. S. Dept. Agr.)

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through the husk and enter the ground to pupate. There are a number of broods during the summer, the last brood passing the winter in the pupa state and emerging as adults in the spring.

Corn is not much attacked after the kernels begin to harden, the insects then turning to other plants such as tomatoes, tobacco and cotton. There are several broods each season, probably four or five in the greater part of this State.

North Carolina Notes.—The notes here given throw some light on the time of emergence, etc., of the insect in this State:

In 1900, on September 18th, Mr. D. L. Wolff, R. F. D. No. 1, Pinnacle, Surry County, sent in adult moths which were captured when on tobacco flowers.

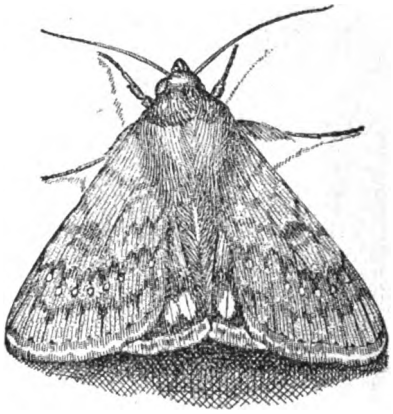

FIG. 17.—The Corn Ear-worm, showing adult moth in natural position with wings not spread. About twice natural size.
(After Quaintance, Bureau Ent., U. S. Dept. Agr.)

In 1902, at Raleigh, adults were observed for the first time in the terminal blades of corn on May 15th. On the 18th eggs were abundant on new silk (it was early corn) and thereafter larvæ were abundant in the ears.

In 1904, the writer found his first adult ear-worm moth for the season at Raleigh, on June 15, though they had likely been out some time previous. This moth was in the funnel formed by the top blades of the corn-plant which was not yet in tassel. On June 18 (same year) eggs were abundant on silk of Adams' early corn in garden, but no worms had yet appeared.

In 1905, on May 18th, Mr. S. O. Lazenby, R. F. D. No. 4, Statesville, sent in a specimen of the adult moth.

These notes show that the adults are abroad early in the spring and also late in the summer, into the fall. The finding of larvæ mature, or

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nearly so, at Maxton on May 31st (1902), is an evidence that they reach maturity quickly. There must, therefore, be quite a number of different broods.

Professor Quaintance calls attention to the fact that when the worms are abundant in corn they may devour one another, thus reducing the number which actually mature. He also observes—and the same fact is evident to all who have observed—that the damage is not measured by the corn actually eaten, but also by the large amount which rots or molds as a result of the insect's work. The holes made through the husk also serve as entrance places for weevils.

REMEDIES.

When this insect attacks other plants, it is sometimes recommended to plant an occasional row of corn for the purpose of inducing the insects to attack the corn so the other crop will be spared. This is an evidence that it prefers corn to other food. This paves the way for a frank statement of the fact that no wholly satisfactory remedy for the Ear-worm in corn is known. Such methods as may be employed with reasonable hope of relief are mentioned below.

As the insect passes the winter in the pupa state in the earth, fall or winter plowing of badly infested lands will kill many of them. Experiments in Kansas[1] "showed that plowing infested cornfields 5 or 6 inches deep in late fall and early winter destroyed practically 100 per cent of the over-wintering pupæ." But in North Carolina it must be remembered that the insect develops in many other crops besides corn, especially cotton and tobacco; hence fields in which these crops stand until freezing weather will likely be infested as well as corn lands. Indeed, if the corn matures early, the latest broods must of necessity develop on other crops, chiefly cotton, hence the plowing of cornfields only would reach only a part of the insects.

In gardens and small patches of corn, something can be done by pinching the tips of the ears by hand, or even cutting off the ends of the ears and feeding them to stock, to prevent the worms going down the length of the whole ear. If the pinching method be used, it should be done several times, to kill as many as possible, for some of the young worms will likely escape each time.

If the corn matures very early, it will not be exposed to the later broods of worms, for the moths prefer to lay eggs on fresh silk and the worms will not work readily in hardened kernels. Thus early planting, and the use of early maturing varieties, would seem to be against the insect; but we must remember that early planted corn is, in general, more hurt by a number of other corn pests, and we do not believe, as yet, that the benefit of very early planting against this insect will amend

[1]Cir. No. 7, Kans. Exp. Sta., "Corn Ear-worm," by T. J. Headlee (1910?).

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for its other disadvantages. We can conceive that any one planting in any one year might largely escape ear-worm by not being in tender silk when the adult moths were out in numbers. But we are not able to forecast the broods with sufficient exactness (nor can we know the rate with which the corn will grow) to make any positive recommendations on this point.

Let us hope that better remedies may be developed in the future.

WEEVILS (Several Species).
Orders *Lepidoptera* and *Coleoptera*.

Description.—Small or medium-sized insects which in the adult or larval state, or both, injure grain by eating into the kernels when stored, or by eating the meal or other products. Sometimes attack corn in the field before harvest. Often troublesome in mills, barns, stores, pantries, etc. The adult insects are moths or beetles.

Injury in North Carolina—There are from eight to a dozen distinct kinds of "grain weevils" in North Carolina, and the total damage by them is great. Prof. R. I. Smith during some special studies of our grain weevils recorded at least nine species as known to him.[1] These were:

(*Lepidoptera*) (Moths): Angoumois Grain Moth,
Indian Meal Moth,
Meal Snout Moth.
(*Coleoptera*) (Beetles): Saw-toothed Grain Beetle,
The Cadelle,
Yellow Meal-worm,
Dark Meal-worm,
Granary Weevil,
Rice Weevil ("Black Weevil").

Undoubtedly the most destructive "weevil" to our corn is the last one in the above list—the "Rice Weevil" or "Black Weevil." It has been sent in to us more often than any other kind. It appears to be the hardest of all the weevils to control. It also often infests the corn in the field, as the following letter from the southeastern part of the State, received August, 1912, shows:

"A year ago a large quantity of corn here was destroyed by weevils before taken from the field. This year a great deal of the early corn has one or two dozen weevils on each ear, and as the corn hardens it is being damaged."

Many other letters could be quoted showing this same general condition.

[1]Bul. 203, N. C. Exp. Sta., "Corn Weevils and Other Grain Insects." R. I. Smith, May, 1909.

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General Life-history of Grain Weevils.—As there are a number of distinct kinds of grain weevils, some seeming to prefer ground grain products, the life-histories vary in details. The account here given is only meant to be general, giving an approximate idea of the whole group.

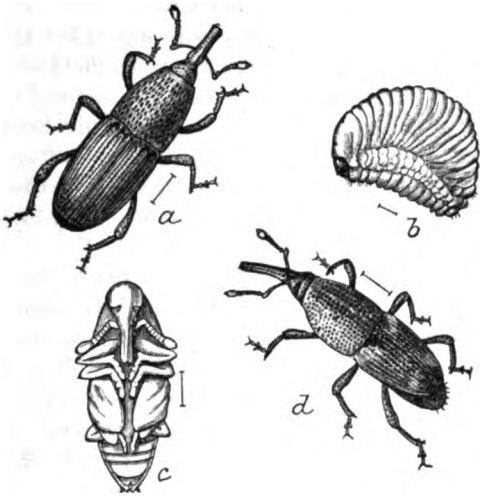

FIG. 18.—Grain Weevils (beetles), showing two closely related species at *a* and *d*; a larva at *b*, and pupa at *c*. Natural size indicated by lines. The one at *d* is the "Black Weevil," our most destructive corn weevil.
(After Chittenden, Div. Ent., U. S. Dept. Agr.)

The adult insects are moths or beetles, mostly small, but a few of medium size. These lay eggs on or in the grain or husk and the worms eat into the kernels. In some species the worm reaches full growth in the same kernel in which it first hatches; in others the same worm may live in several different kernels. When grown, the worm changes to a pupa from which the adult moth or beetle emerges later. In the case of weevils infesting meal, bran, and other ground materials, the worms burrow around in the material, frequently spinning a web which fastens little masses together. Meal and other products thus infested are apt to become moldy and unhealthy as food for both man and beast. Where the whole grain is infested, the vital germ is often eaten out, thus spoiling the grain for seeding purposes.

In the previous Bulletin of this Department on "Corn Insects" the writer stated that adult weevils had been found "passing the winter in the remnants of fodder where this had been pulled," but he has not now the original note at hand. His recollection is that it was the "Black Weevil," found in winter in the husk remaining attached to the stalk.

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REMEDIES.[1]

Prevention.—Thorough cleaning out of old bins, sweeping out stray shattered grains, chaff, litter, etc., will get rid of many of the Weevils that are breeding in the bins so as to give the new crop a start with fewer Weevils to contend with in the beginning (save those in the corn when brought from the field).

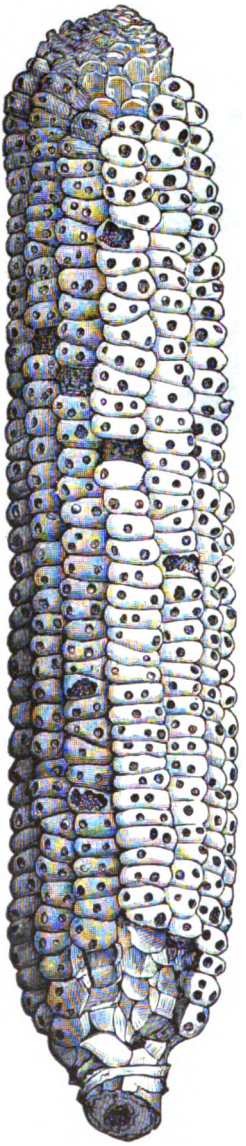

FIG. 19.—Ear of corn riddled by Angoumois Grain Moth. A case of excessive injury.

The letter already quoted showed special damage to the early corn. Professor Hinds in Alabama in the bulletin already referred to, stated that up to midwinter his records showed "about fifty times as many Weevils on early corn as on late corn."

It is commonly believed in this State (and Professor Hinds mentions the same for Alabama) that corn stored in the husk is not so liable to Weevil attack. Prof. R. I. Smith, in the North Carolina Bulletin already referred to, calls attention to the fact that tight-fitting husks do appear to protect the corn to some extent. But the ear-worm has already often eaten holes through the husks so that Weevils gain entrance, and once the Weevils are in, the writer maintains, as in his previous Bulletin, that the husk merely hides the injury and causes the farmer to *think* that there is less Weevil. Professor Hinds says that the value of the husk as a protection depends on the *length and tightness* of the husk. On this point of storing in husk, we think we are safe in saying that it is not to be relied upon, except for those ears which have long tight husks. To depend on preventing Weevil merely by storing the whole crop in husk will result in many disappointments, for many of the ears will have torn or damaged husks, or ears protruding beyond the husk, etc., which will merely invite Weevil to enter.

Farmers in this State have also told us that if the corn be slightly dampened when stored (in husks) that it undergoes slight heating which seems to protect it from Weevil. Use of salt, ashes, lime, and cedar or pine twigs for

[1]In this account I have drawn upon Bul. 203, N. C. Exp. Sta., by R. I. Smith, already referred to, and on Bul. 176, Ala. Exp. Sta., "Reducing Insect Injury to Stored Corn," by W. E. Hinds, Feb., 1914.

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putting in bin with the corn have all been mentioned, and must be classed among the remedies or preventives that have not been adequately proven. In his former Bulletin the writer stated that "shelled corn may be placed in absolutely tight bins and top of each bin covered with a complete layer of lime or ashes to depth of an inch. Of course, this is only practicable for those bins that are not being continually disturbed." This suggestion is not based on actual tests, but only as a chance to keep the Weevils out, and would be in no sense a remedy for those already in the corn.

Fumigation Treatment.—But for the Weevils that are already in the corn, or the ones that may gain entrance after it has been stored, we know of no treatment other than fumigation with some poisonous gas that can be relied upon, and some recent testimony shows this to be less certain than was formerly believed!

For this purpose the material known as carbon bisulphide (or carbon disulphide) has long been, and still is, the standard material. It is a clear, foul-smelling liquid which evaporates rapidly, giving off poisonous fumes. It is necessary to have the grain in some *tight* receptacle, *absolutely* tight if possible, or at least as near to it as possible. For small quantities, as for seed grain, etc., a water-tight barrel or cask can be used, or boxes if cracks and covers be sealed by pasting paper closely over them. The tighter the better, and the less the barrel, box, or bin approaches to perfect tightness the less perfect you must expect the result to be, and the greater amount of the material you must use in the *effort* to make amends for leaking of the gas.

A brand of the chemical especially made for insect work is manufactured by E. R. Taylor, Penn Yan, N. Y., under the name of "Fuma Carbon Disulphide," and is sold in lots of 50 lbs. or more. In small quantities the chemical can be had from, or ordered through, many drug stores, at retail prices of about 30 cents per pound (pint).

The amount to use is figured on the air space in the barrel, box, bin, or room (not merely on the amount of grain). Professor Hinds in Alabama says this should be *at the rate* of 5 to 8 lbs. for 1,000 cubic feet of space if the room or bin is quite tight, varying up to as high as 20 or 25 lbs. per 1,000 cubic feet of space if only moderately tight as by lathing the cracks, and says that for use in barrels ("for peas") "about one-half teacupful is sufficient if the top be tightly covered." The "Black Weevil" in corn may require more than this amount, perhaps three-fourths of cupful.

Professor Hinds says: "In making the application, level the surface and prepare small holes about a foot deep, about 3 to 4 ft. apart. Divide the liquid among these holes; pour direct on the corn in the holes and fill the holes with corn." If the room is large, begin on the farther end, working toward the door. "Close door tightly and quickly paste paper over the cracks; leave closed for at least 24 hours; no harm

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if left indefinitely; fumigation is more effective during warm weather; never attempt it when temperature is below 60 degrees. A second treatment (stronger) should be given after a week or two if it appears that the first was not effective."

Prof. R. I. Smith, after working in North Carolina, became convinced "that carbon bisulphide, at any reasonable strength, cannot be successfully used in *ordinary* corn cribs, grain boxes, or storerooms. Small quantities can be fumigated in absolutely tight boxes or barrels by using about one ounce to three bushels; the top must be air-tight, not simply covered with blankets or canvas. Fumigation should continue for about 24 hours." He found that some stages of the insects would survive treatment; especially eggs and pupæ.

Which leads the present writer to insist that one may expect imperfect results, but still this fumigation method is the best known when once the corn is infested. Have the corn free to begin with, if possible, by cleaning the bins, and perhaps even throwing out ears already visibly infested; have the bins tight, so that they can be fumigated if necessary; use enough of the bisulphide to make allowance for leakage through such cracks as there may be; and finally, if the treatment seems not to have killed all, give a second treatment a week or two later to kill larvæ and adults which may have developed from eggs or pupæ which survived the first treatment.

Caution.—Carbon bisulphide is like benzine in its nature, both the liquid and its fumes being very inflammable, and no light or fire of any description can be brought near while the fumigation is going on, not even a lamp, cigar, or pipe. After the fumigation is over, open the bin (box, or room) and air out. If these cautions are heeded the material is safe to use.

Heat.—It has long been known that insects are killed by high temperatures, and this fact has been made use of recently in some striking tests by Mr. George A. Dean of the Kansas Experiment Station in ridding flour-mills of insects by the heat method.[1] In summarizing his work, he says:

"A temperature of from 118 to 125 degrees is sufficient for any part of the mill. This temperature should be held several hours to allow the heat to penetrate all the infested parts (of the mill)." But he also says: "I would not recommend heat for killing insects in stored seeds and grain. In case they are stored in small quantities, the heat method would be entirely satisfactory; but if in large quantities it would require too much heat to penetrate to center of bins."

LESSER CORN INSECTS.

We have devoted the greater part of this BULLETIN to those insects which are regular serious pests of corn in this State. It now remains to make brief mention of a few which are of minor importance or which

[1]Jour. Ec. Ent., Vol. 6, p. 40, Feb., 1913.

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are only occasionally destructive. For these we enter into no lengthy discussions either of injuries, life-histories, or remedies.

Seed-corn Maggot (Order *Diptera*).—A white maggot infesting seeds of corn, preventing germination. Once reported from Forsyth County as damaging corn which had been planted, and presumably the same once reported from Rowan County infesting planted seeds of melons. The attack is made after the seed is planted. The adult insect is a gray slender fly, smaller than house-fly. Remedies not very available, and in this State not much needed.

Flea-beetles and Leaf-beetles (Order *Coleoptera*).—Several species of these are known to attack young corn, eating the blades. Several complaints have been made in this State, but injury never widespread and usually not serious. Adult insects (which do the damage) are small, usually shining beetles, often jumping or dropping quickly when disturbed. Remedies scarcely necessary. Dusting with ashes, or with Paris-green in ashes or lime (1 ounce to 1 lb. ashes) would probably drive many away.

Red Spider (not a true insect).—This small creature is related to the spiders, mites, and ticks. Primarily a pest on cotton, sometimes on corn, peas, etc., especially in long hot spells. Rainy weather checks them.

Grasshoppers (Order *Orthoptera*).—We have many native kinds which feed on corn, but usually not destructive and the injury is soon outgrown. Some appear full-winged in spring, others are in young wingless state in spring and develop wings in summer and fall. When serious they can be combated by use of poisonous baits.

Lady-beetles (Order *Coleoptera*).—One of our most common Lady-beetles is frequently seen on corn where it feeds to some extent on the pollen, blades, and the soft kernels. This is the Thirteen-spotted Lady-beetle *(Megilla maculata)*. The species also feeds to some extent on other insects, and its larva is entirely insectivorous in its diet, feeding on plant-lice, slugs, etc. Frequently specimens of this beetle may be found on blades of corn standing over a small silken cocoon of yellowish or brownish color.

FIG. 20.—Lady-beetle (*Megilla maculata*) from which a parasite has emerged and spun its cocoon beneath the insect. Slightly enlarged, size of beetle indicated by line above. Lady-beetles of this species parasitized in this way may frequently be found on blades of corn. (After Riley, Div. Ent., U. S. Dept. Agr.)

Such a cocoon contains a parasite, the larva of which has issued from the beetle. In a few days the adult parasite emerges from the cocoon as a small winged wasp-like creature, which goes off to seek a Lady-beetle victim. The beetle invariably dies soon after the parasite emerges.

Stinging Caterpillars (Order *Lepidoptera*).—There are two kinds of caterpillars frequently found on corn which if brushed against carelessly may produce painful stings. One of these is known as the Saddle-back

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Caterpillar (*Sibenne stimulea*), so called from the peculiar saddle-like markings in the middle of the back. This caterpillar when grown is about an inch long. There are two projections at each end of the body which are directed upward and outward, and these projections as well as other parts of the body are armed with sharp brittle spines which readily pierce the skin and break off. The general color of the larva is greenish, with a reddish-brown patch resembling the saddle, and a similar patch at each end of the body from which the projections arise. The caterpillar when grown spins a cocoon from which it comes out as a brownish moth. There seems to be but one annual brood, the adult moths issuing in spring or early summer. Ammonia, bicarbonate of soda, or even strong brine, are recommended as antidotes for the sting.

Our other species of stinging caterpillar is the larva of the Io Moth (*Automeris io*). This is a rather handsome pea-green caterpillar attaining a length when full grown of two inches, with a purple stripe down each side of the body, the whole body armed with yellowish spines which are borne in clusters on little warts or tubercles. When grown the larva spins a brownish silken cocoon within which it transforms to a handsome moth, the males being yellowish and expanding two inches from tip to tip of the wings, and the females yellowish-brown and expanding as much as three inches in large specimens. In both sexes the hind wings are marked with conspicuous eye-spots.

Other Caterpillars (Order *Lepidoptera*).—Various caterpillars of many kinds may be found on the corn plant, all transforming to moths of some kind. Most of these, however, are not serious, or, if so, are only destructive in sporadic outbreaks.

* * *

In concluding this BULLETIN it is but fair to repeat that in its preparation the writings of others have been freely drawn upon. Without crediting each statement made, the author has named the principal papers in footnotes. Many of our own observations are also included. It would take years and years of concentrated effort for any one person to work out all such facts as have been here recorded on the insects attacking this one crop—corn. But the writer is persuaded that there is a proper demand for bulletins of this type, each discussing all the more important insect pests of some one important crop. Such a bulletin cannot always be made up entirely of facts ascertained, proven, and tested by the writer in person.

The writer will welcome correspondence with corn-growers who make use of the suggestions contained herein, and who carefully watch the results. He also desires to be promptly informed in case of any serious outbreak of any corn pest not mentioned in these pages.

FRANKLIN SHERMAN, JR.,
Entomologist, Dept. Agriculture, Raleigh, N. C.

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THE BULLETIN

OF THE

NORTH CAROLINA

DEPARTMENT OF AGRICULTURE

RALEIGH

Vol. 35, No. 7. JULY, 1914 Whole No. 198

Hog Cholera and Its Prevention by the Use of Anti-Hog Cholera Serum

PUBLSHED MONTHLY AND SENT FREE TO CITIZENS ON APPLICATION.

Entered at the Postoffice at Raleigh, N. C., as second class matter,

February 7, 1901, under Act of June 6, 1900.

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LETTER OF TRANSMITTAL.

RALEIGH, N. C.

HON. W. A. GRAHAM, *Commission of Agriculture.*

SIR:—I beg to submit herewith manuscript on Hog Cholera and its prevention by the use of anti-hog cholera serum. I recommend that this manuscript be published as the July BULLETIN.

B. B. FLOWE,
State Veterinarian.

Approved for publication.
W. A. GRAHAM,
Commissioner of Agriculture.

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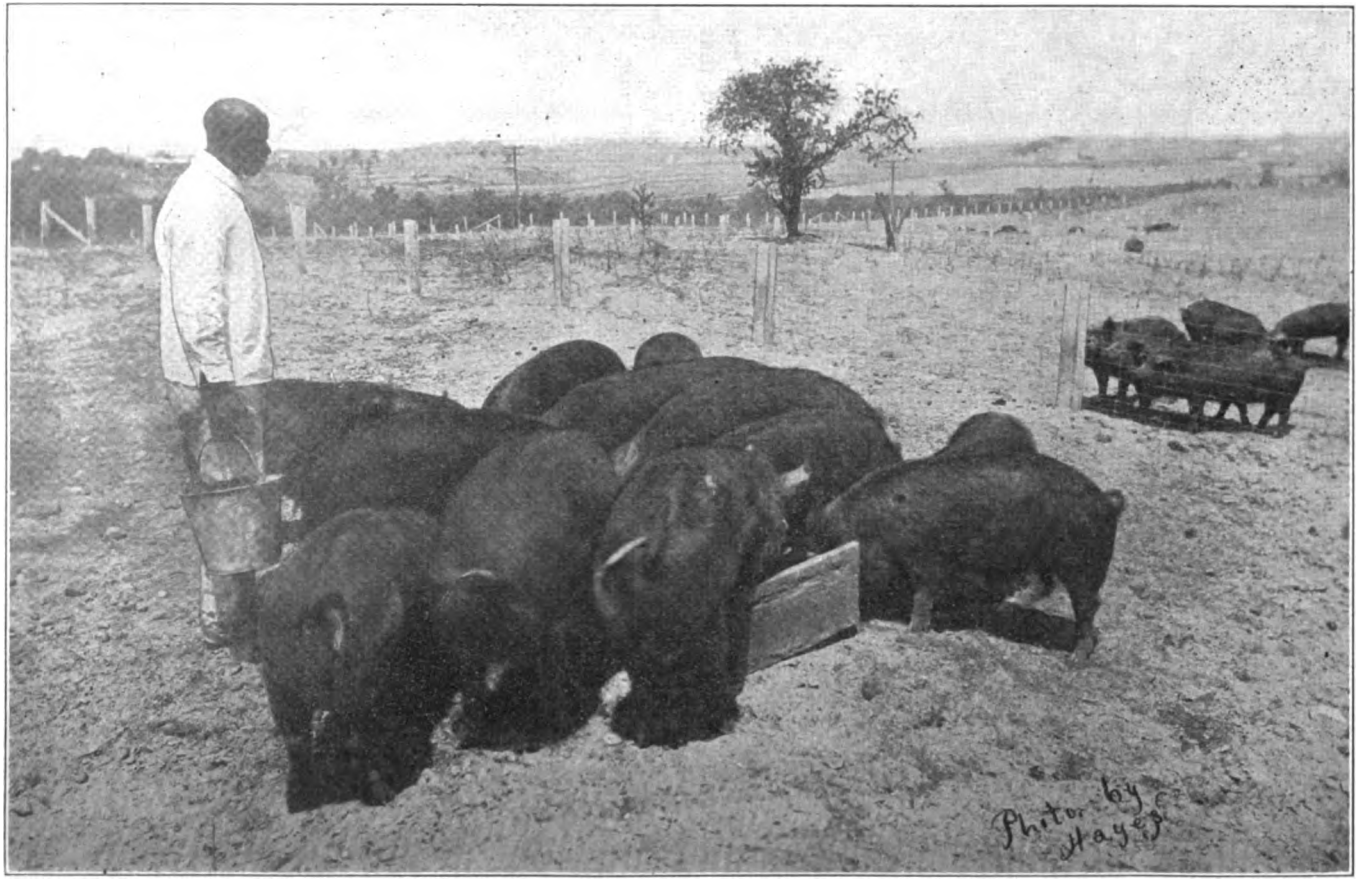

FIGURE 1.—Group of pure bred Berkshires (immuned).

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HOG CHOLERA

BY B. B. FLOWE, STATE VETERINARIAN.

Hog cholera is a higly contagious and infectious disease of hogs. It is characterized by high fever, ranging from 104 to 107 degrees Fahrenheit, loss of appetite, red or purple spots on the belly between the forelegs and on the ears, and a muco-purulent discharge from the nose and eyes. This discharge often pastes the eyelids together, and causes a snuffling sound in breathing. In the last stage of the disease, and just before death, the animal has muscular tremors and wobbling gait.

Period of Incubation.

The period of incubation is the number of days between contracting the germ causing hog cholera, and the manifestation of the first symptoms or evidence of sickness. This time ranges from four to twenty-one days, depending on the susceptibility of the individual hog and the virulence of the infection.

An acute form of hog cholera indicates a virulent form of infection, while a slow or chronic form of hog cholera indicates an infection weak in virulency.

Symptoms.

A post-mortem and anti-mortem study of hog cholera will show a greater variety of symptoms than any other disease affecting hogs. For this reason, it is often hard for the farmer who has not had special training along this line to detect the first sick hog in his herd, and often a large per cent of his hogs are sick before he even suspects they are sick. Then not being able to detect the nature of the disease he does nothing until most of his hogs are sick and the first ones to show any signs of being sick are beginning to die, when it is too late to do anything. So far, we know nothing that will cure an advanced case of hog cholera. Then, again, we see in some herds one or two hogs that contract a mild form of the disease and are off feed for a few days, but soon recover. From these animals the entire herd may become infected, and this before cholera is even suspected.

In the chronic form we are more apt to be deceived, and this is especially so when there has been a previous outbreak of an acute form on the farm. This is so because in the chronic form the affected hogs will linger along for weeks and sometimes for more than a month before they finally die, or recover, as the case may be. But the acute form usually wipes the entire herd out within a short time after it first gains entrance in the herd.

Among the first symptoms seen in hogs affected with cholera is a loss of appetite, a tendency to hide in the litter or some secluded place and if forced to get up they show a stiffness in their gait, as if they had tender feet, and the back is usually more or less arched. At first there

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is a tendency towards constipation which is followed in a few days by a very fetid diarrhea. In light skin hogs, and at times in dark skin hogs, a red or purple discoloration of the skin can be detected along the belly between the fore legs and at the base of the ears. This symptom is not always present but is frequently seen. When cholera is suspected, it is well to secure a clinical thermometer and take the temperature of a number of those hogs that are eating and apparently well.

We frequently find in a herd where there has been one or more sick hogs for several days a number of the hogs apparently well showing a temperature as high as 104 to 107 degrees Fahrenheit, and even higher. Hogs affected with cholera will often carry these high temperatures from three to five days and appear to be entirely healthy, but are ready to come down with an acute form of cholera. The normal temperature of a hog is from 101 to 102 degrees Fahrenheit.

Owing to the high temperature, lack of appetite and general depression, vomiting, thumps, quick or jerky breathing is frequent. The muco-purulent secretion from the eyes often becomes so heavy that the eyelids are adhered together causing the hog to become blind.

The most striking difference between the acute and chronic form of cholera is the duration of the disease. In the chronic form the temperature is not so high. The hog may continue to eat a little every day but becomes unthrifty and emaciated and may linger along in this condition for three or four weeks before dying. The acute form usually terminates in death between the eighth and fourteenth day.

When there is any doubt of the sick hogs being affected with cholera, a post-mortem examination should be made on one of the sick hogs in order to make an accurate diagnosis.

POST-MORTEM APPEARANCES.

Skin.—A close examination of the skin will show red or purple spots along the belly, between the fore and hind legs and at the base of the ears; this is especially so in light skin hogs. In chronic cases the skin may become dry and hard and slough out in places. The ears and tail may also slough off.

Stomach.—The mucous membrane or inner lining of the stomach may be very much inflamed and red, frequently showing evidence of ulcers.

Lymphatic Glands.—Enlarged, congested, showing hemorrhagic spots when cut open. Of these glands receiving special attention in hog cholera are the mesenteric glands, or those along the intestines; lumbar and retroperitoneal are those lying near the back wall of the abdominal cavity; the lymphatic glands found near the angle of the jaw; the mediastinal and bronchial glands in the region of the heart and lungs, and the inguinal glands found beneath the skin high upon the inside of the thigh.

Intestines.—The inner lining, or the mucous membrane of the intestines, especially near the ilco-cecal valve, the place where the small intestine opens into the large intestine, may be congested and covered with small red spots. At this point in the intestine it is not uncommon to see ulcers varying in size and shape. One of the most constant is the somewhat circular button-shaped ulcer standing out from the surround-

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ing mucous membrane, with a greenish-yellow center. The outer surface of the large and small intestines may be literally covered with bloody spots. Small greenish-yellow ulcers may be seen on the outer surface of both small and large intestines.

Spleen.—Almost without exception, the spleen or "milt" is enlarged, dark and soft and covered with small red spots and easily ruptured.

Kidneys.—When the capsule, or covering of the kidney is removed, dark red spots are seen. Frequently these hemorrhagic spots are so numerous that it reminds one of the speckling of a turkey's egg. Congestion and hemorrhagic spots are also detected when the kidney is cut open.

FIGURE 2.—Ulcers (large intestine), chronic form.

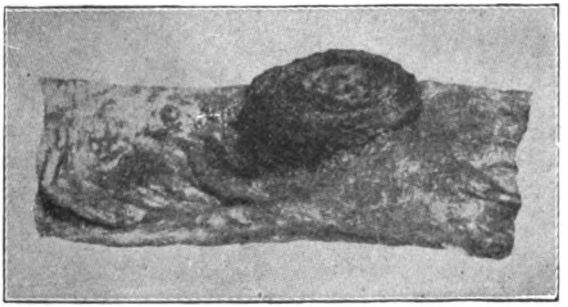

FIGURE 3.—"Button ulcers" (large intestine), chronic form.

Bladder.—The inner lining of the bladder may be found congested with numerous hemorrhagic spots on the surface.

Heart.—Numerous petechiæ and hemmorrhagic spots may be found on the heart.

Lungs.—In well defined cases of cholera small red or hemorrhagic spots may be found on the lungs. Again large, dark, consolidated spots are found, due to congestion and collapse of the lung tissue. In the chronic form pus may be found in the lungs. Sometimes the lungs are adherred to the chest walls and diaphragm.

SYMPTOMS USUALLY FOUND IN WELL DEFINED CASES OF HOG CHOLERA.

Anti-Mortem.—Lack of appetite, unthrifty, high temperature, emaciation, arched back, wobbling gait, red or purple skin along the belly be-

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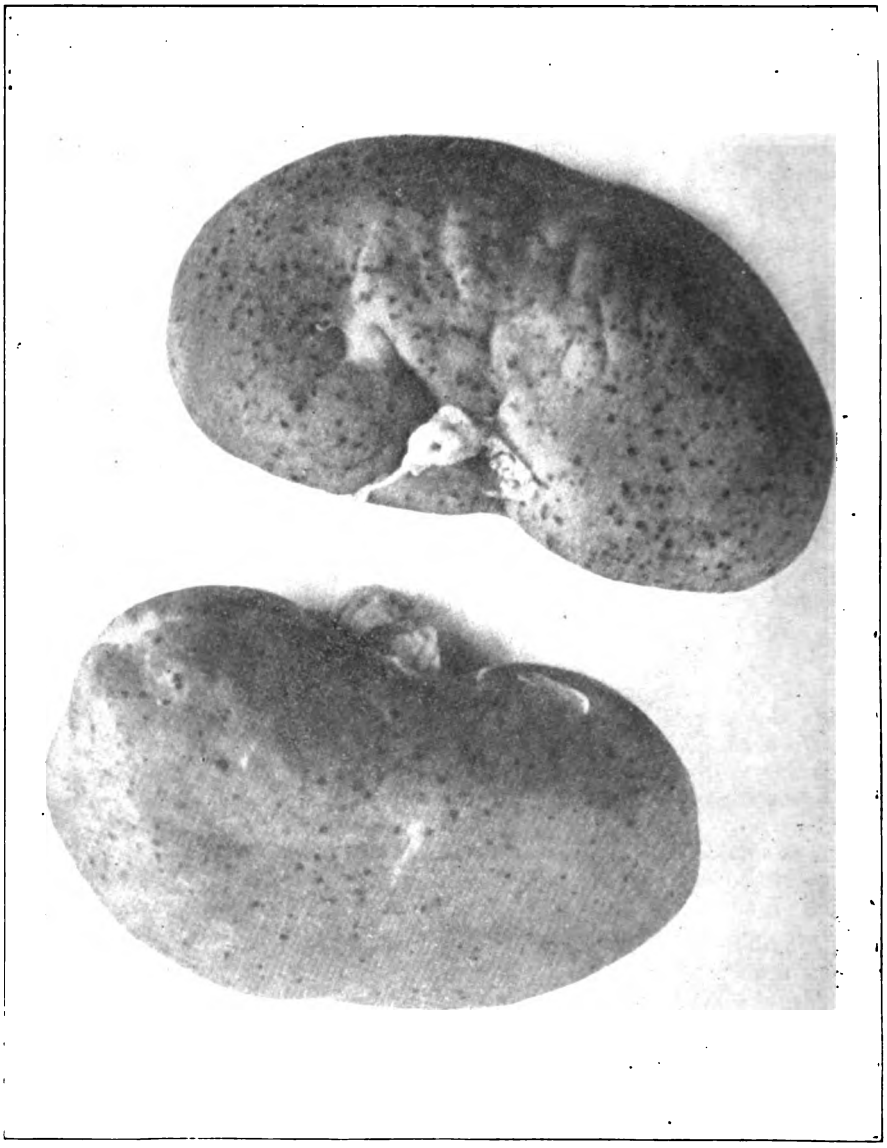

FIGURE 4.—Kidney, showing typical lesions of hog cholera (hemorrhagic spots).

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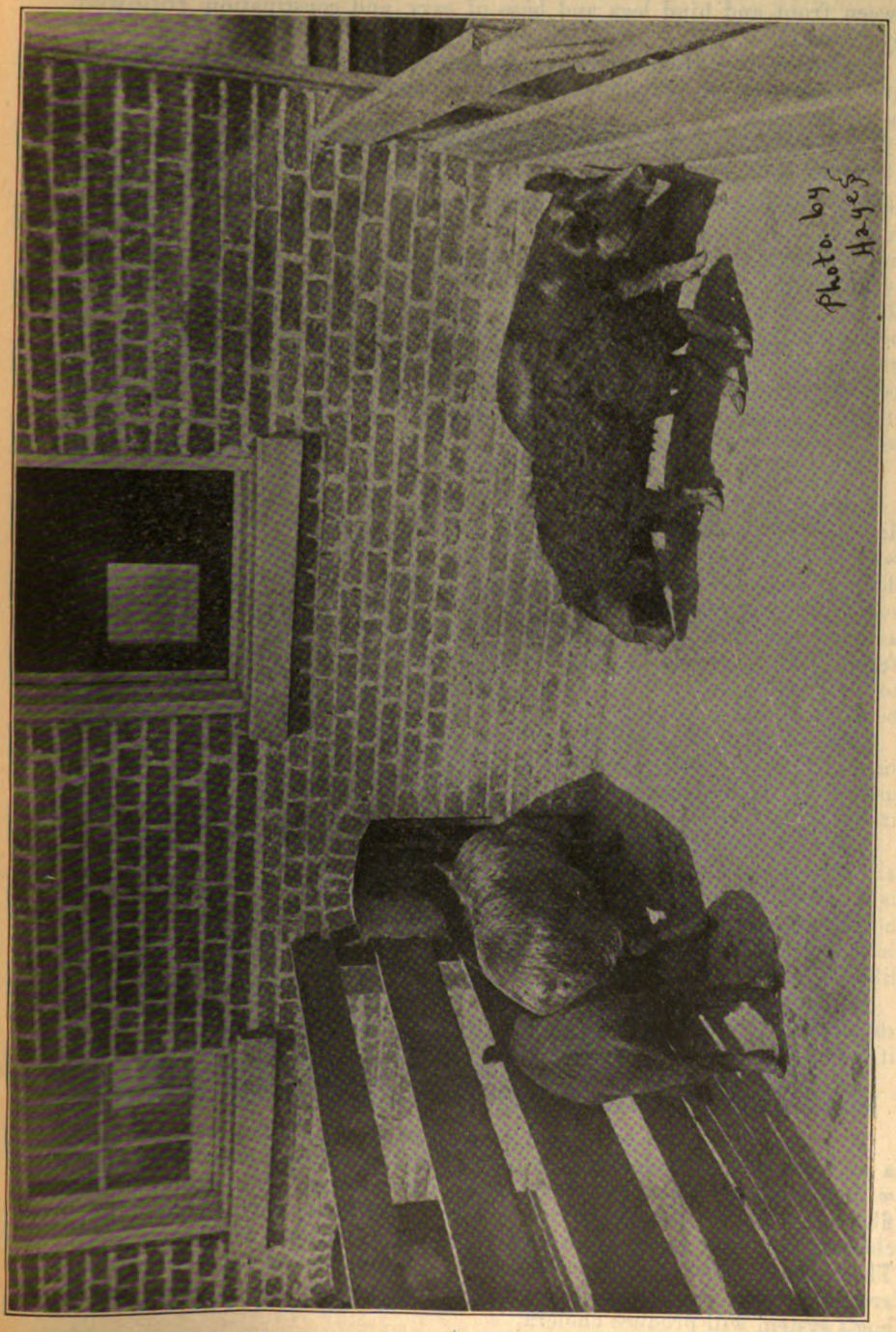

FIGURE 5.—Hogs affected with cholera.

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tween front and hind legs and base of ears, and constipation followed by diarrhea.

Post-Mortem.—Hemmorrhagic spots on kidney, lung, intestinal lesions and congestion of lymphatic glands. Congested spleen studded with petechiæ spots.

INFECTED PREMISES.

The length of time before it is safe to put non-immune hogs on infected premises will depend largely upon the character of the grounds infected. If the grounds are well drained and are not covered with too much litter, so that the rays of the sun will reach all parts of the ground, it would probably be safe to add susceptible hogs to the premises in three months. But, if the grounds are not well drained and have low, wet or marshy places, it would not be safe to add susceptible hogs to the grounds under twelve months, or even longer. When conditions will permit every effort possible should be made to thoroughly disinfect the infected premises before hogs that are susceptible to cholera are added to the premises.

SANITATION.

Under the ordinary farm conditions, it is practically impossible to disinfect thorough enough to kill out all of the hog cholera infection, but where possible all litter should be raked up and burned. This can be done in small lots and should be followed with a spray of a five per cent solution of carbolic acid, lysol, creolin or any other reliable disinfectant, and a liberal application of lime. The pens and houses can be disinfected in a like manner; if they are inexpensive ones it would be better to tear them down and burn them. All mud holes and cesspools should be drained and filled up.

If these measures are followed one would most likely be safe in adding susceptible hogs to the premises. If the hog lots or pastures can be used for any other purpose and new quarters can be found for the hogs, it would be much safer.

Susceptible hogs should be treated with anti-hog cholera serum if they are to be placed on the infected grounds under twelve months. Since it is practically impossible to thoroughly disinfect a large premise, the hogs should be immuned to cholera before they are allowed access to the infected grounds, but bear in mind it is always well to use disinfectants liberally around hog houses.

When cholera has broken out in a herd of hogs in a field, this field should be covered with a heavy application of lime, and a crop grown on it for one year before it is used again, unless the hogs are "immune."

SOME OF THE WAYS BY WHICH HOG CHOLERA IS SPREAD.

It is well to bear in mind that every case of hog cholera comes from a previous case of cholera. It is impossible to produce a case of cholera without having the germs that cause hog cholera. No matter how filthy the lots or pens in which the hogs are kept, they cannot have cholera unless the germs from a previous case of cholera are introduced. The disease cannot arise spontaneously. All secretions and excretions are laden with the infection and if allowed to enter into a susceptible hog's system will produce cholera.

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(From group in State Museum—mounted by T. W. Adickes.)

FIGURE 6.—Buzzards feeding on cholera carcass.

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Since hog cholera must come from some previous case of cholera, it behooves us to see that the carcasses of all hogs dying from cholera are properly disposed of. The infected lots and pens should be held under strict quarantine. All cholera carcasses should be burned or buried deep and covered with lime. Cholera may be carried from an infected premise by dogs, cats, rabbits, crows, pigeons, buzzards or any other animal that moves from one place to another.

THE TURKEY BUZZARD.

The turkey buzzard is one of the three worst agents by which hog cholera is disseminated in this State. The other two are free range, and running streams and overflows. Whenever the carcass of an animal is left on top of the ground, no matter what was the cause of death, the buzzards are certain to be attracted to the carcass. If the carcass is one of a cholera hog they feed upon it and fly away to some other farm, at times many miles away and they are certain to carry the hog cholera germs with them. If these germs are deposited in reach of other hogs they are certain to cause an outbreak of cholera. The importance of burying all carcasses, especially all cholera carcasses and carcasses of other infectious diseases, cannot be emphasized too much.

There is a general impression among all farmers that the buzzards are protected by law. This seems to be an erroneous idea. After a considerable search of the statute, we have been unable to find any law that would protect the buzzard. Since there is no question but what the buzzard disseminates disease germs, especially hog cholera germs, every farmer would be justifiable in killing all the buzzards he possibly can.

RUNNING STREAMS AND OVERFLOWS.

The infection can be carried for miles down a running stream. If infected hogs are allowed access to the stream of water running through the farm, the stream then becomes a source of disseminating the infection over a wide area. So it is not safe to allow hogs to have access to running streams that do not have their origin on the farm.

The overflows in the Eastern part of this State are a source of disseminating the infection over a wide area. Especially is this so where the dead hogs are not properly disposed of, or where the hogs die in the swamps and no attempt is made to locate and bury them.

Often hogs in the free-range territory die from cholera in a running stream or in large swamps and are never seen by their owners. These hogs serve as centers from which infection is scattered broadcast during overflows.

PUBLIC ROADS.

The public roads are another source of disseminating the infection. Sick hogs often have access to the public roads and leave them infected. It then becomes dangerous to drive well hogs on the public highway.

SHOW HOGS.

Often hogs contract cholera at shows and when brought back to the farm, and turned in the lots with the other hogs, become the agent by

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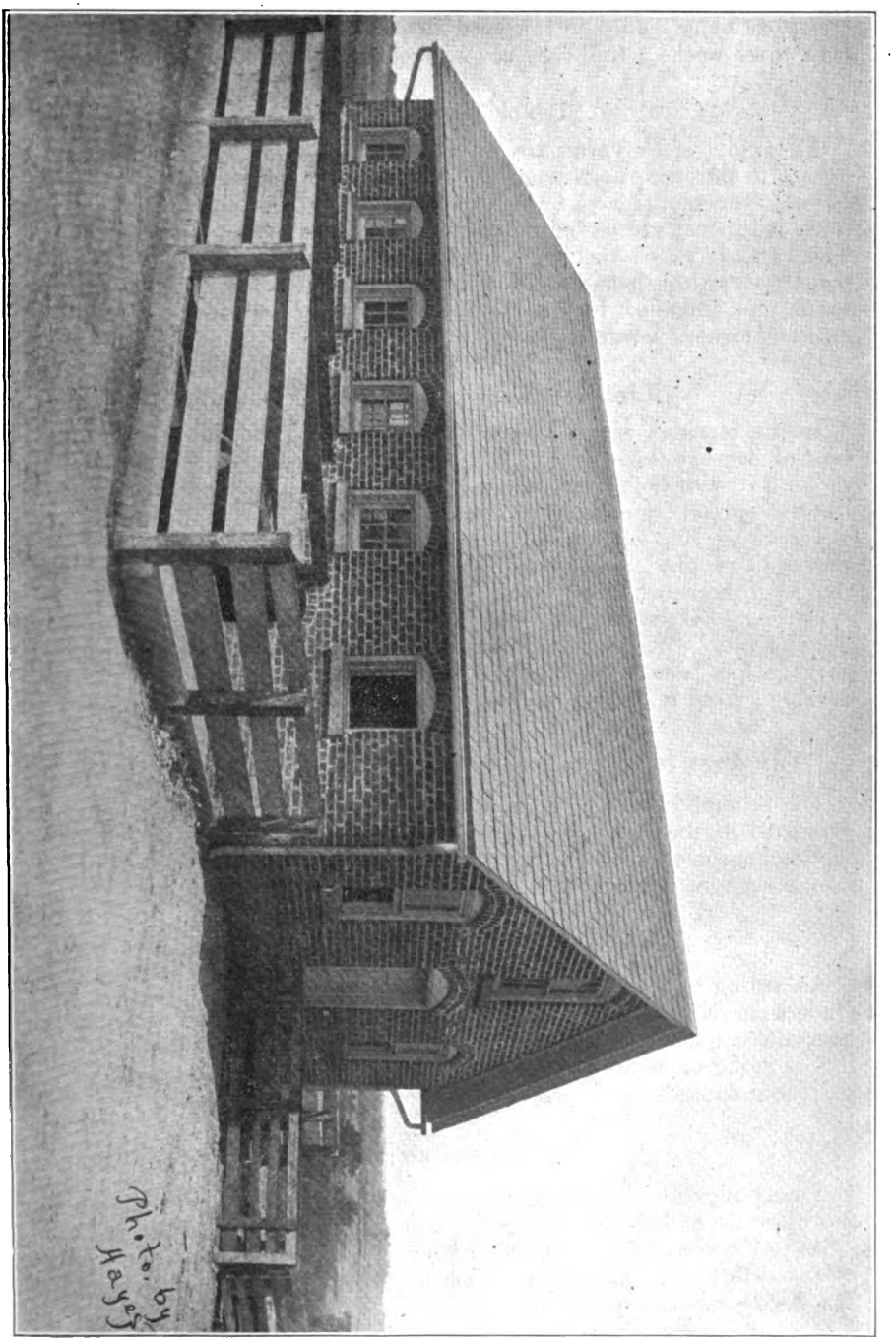

FIGURE 7.—Hog house.

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which the entire herd is infected. All hogs coming from the shows or new hogs being added to the herd should be held under quarantine at least three weeks before they are allowed to run with the other hogs.

PUBLIC STOCK YARDS.

All public stock yards are infected with hog cholera germs. It is unsafe to purchase hogs from stock yards for breeding or feeding purposes. Nor should hogs intended for breeding or feeding purposes be unloaded in pens to be fed unless these pens are thoroughly disinfected. The cars in which the hogs are shipped should be thoroughly disinfected before the hogs are loaded. All hogs unloaded in public stock yards, not intended for immediate slaughter, should be treated with anti-hog cholera serum.

INFECTED HOGS RUNNING AT LARGE.

In the territory where live stock run at large, we find a larger per cent of hog cholera. This is due to hogs affected with cholera coming in contact with hogs from adjoining farms. In this way the infection in often spread from farm to farm.

Visitors.—Hog cholera infection can be carried on the shoes and clothes of people. It is unsafe for any one to visit an infected herd and return to their own or any other herd of hogs.

Garbage.—Uncooked garbage from hotels, restaurants or other sources is dangerous. We know of no instance in this State where uncooked garbage has been fed for any length of time where cholera did not develop. Feed it only to immuned hogs or have it thoroughly cooked.

THE ANNUAL LOSS IN THE UNITED STATES FROM HOG CHOLERA.

The annual loss of hogs in the United States from hog cholera is estimated at the enormous sum of sixty million ($60,000,000) dollars. If this enormous loss of a preventable disease was checked it would go a long ways in reducing the high cost of pork.

THE ANNUAL LOSS IN NORTH CAROLINA.

According to the best information we have the annual loss from hog cholera in North Carolina, both direct and indirect, is considerably over three quarters of a million dollars ($750,000). This enormous loss is going on while many thousands of dollars are being sent out of the State annually for pork, lard and other meat products.

SUSCEPTIBILITY.

Young pigs and young shoats are more susceptible than older hogs, but often we find the older hogs the first to succumb to the disease.

As to the susceptibility of the different breeds, we do not believe there is any difference. The "scrub" hog and "mule-footed hog" succumb to the disease as readily as the pure breeds.

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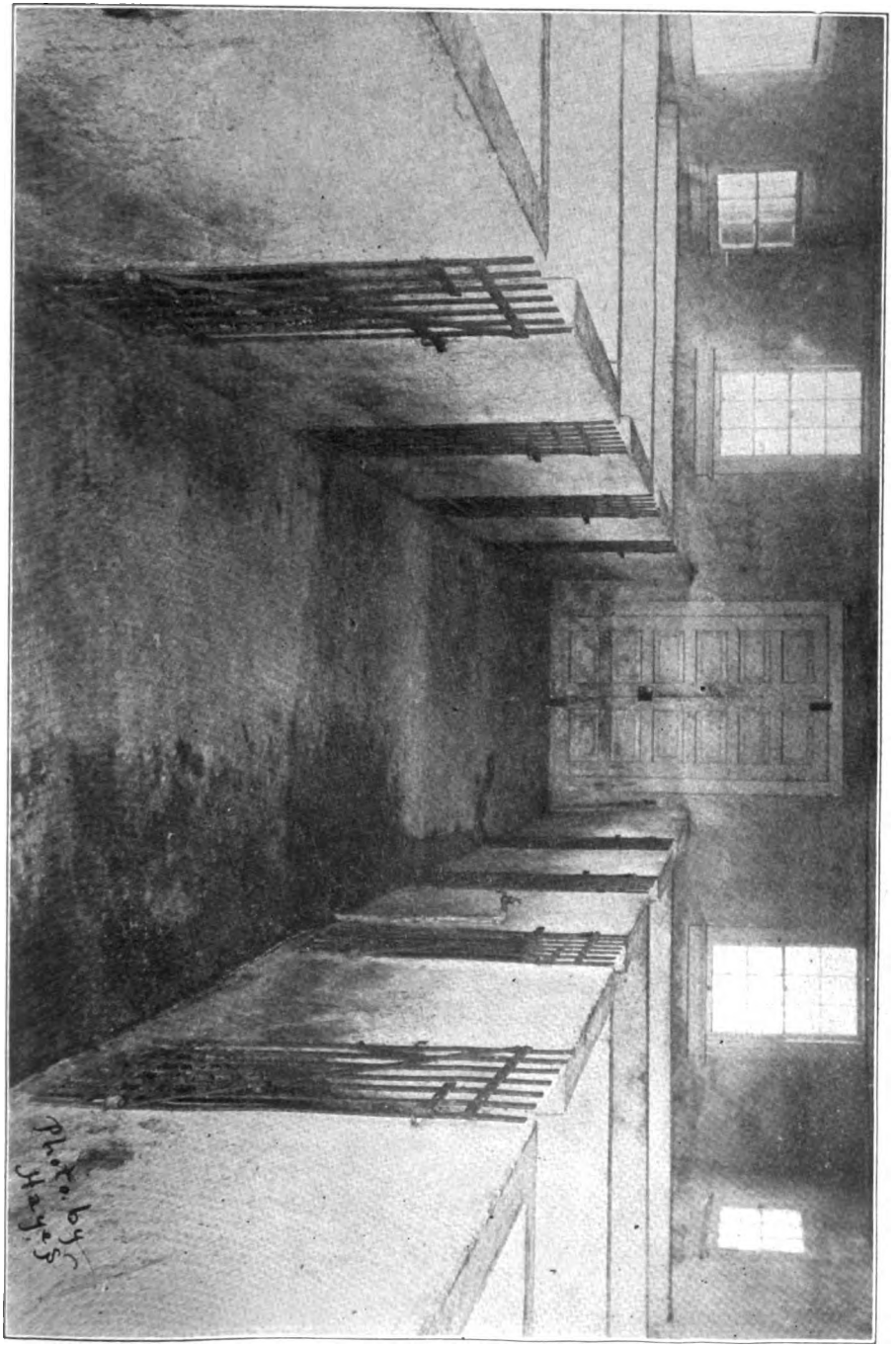

FIGURE 8.—Interior of hog house, showing concrete pens.

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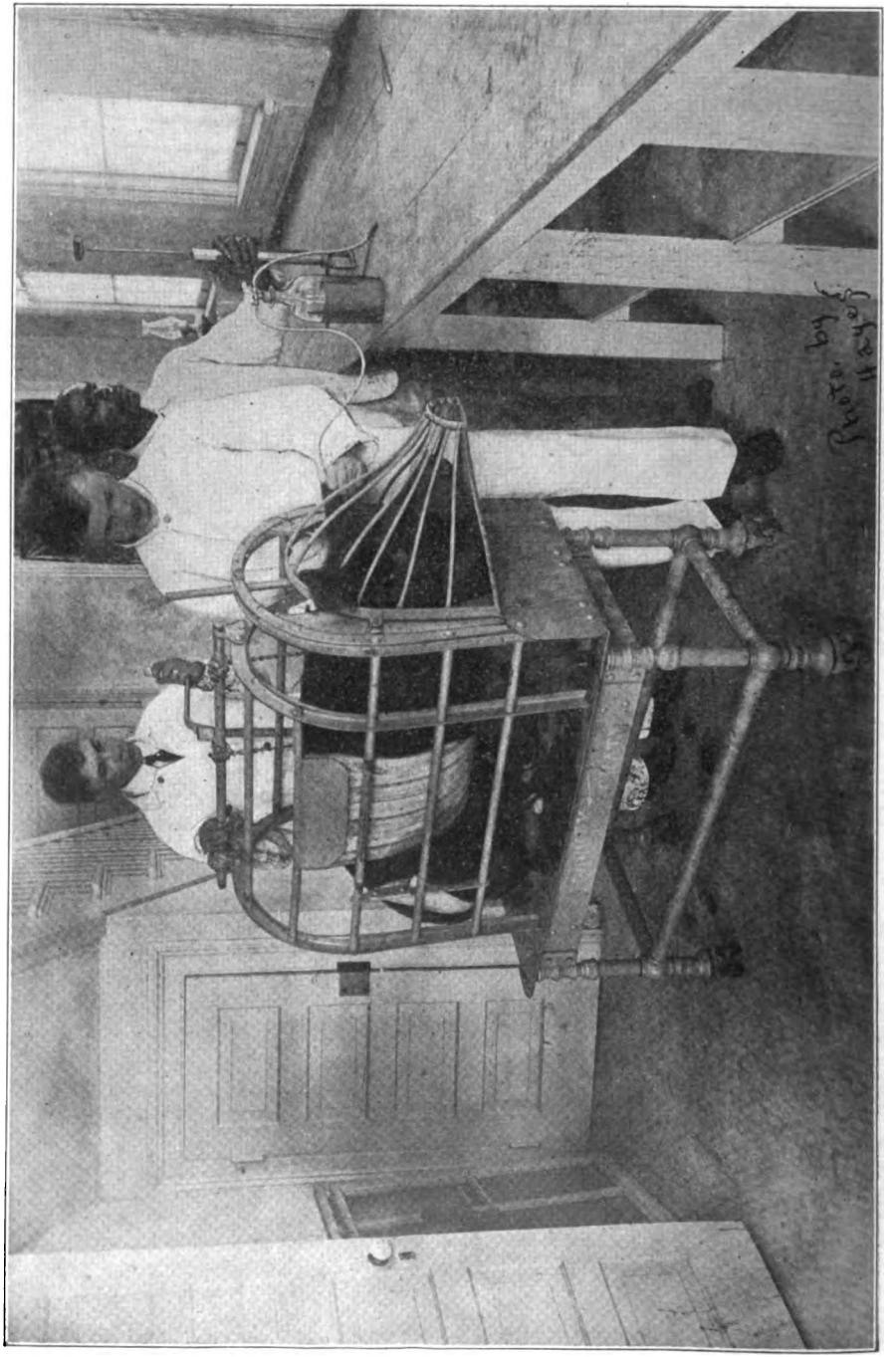

FIGURE 9.—Hyperimmunising (left ear).

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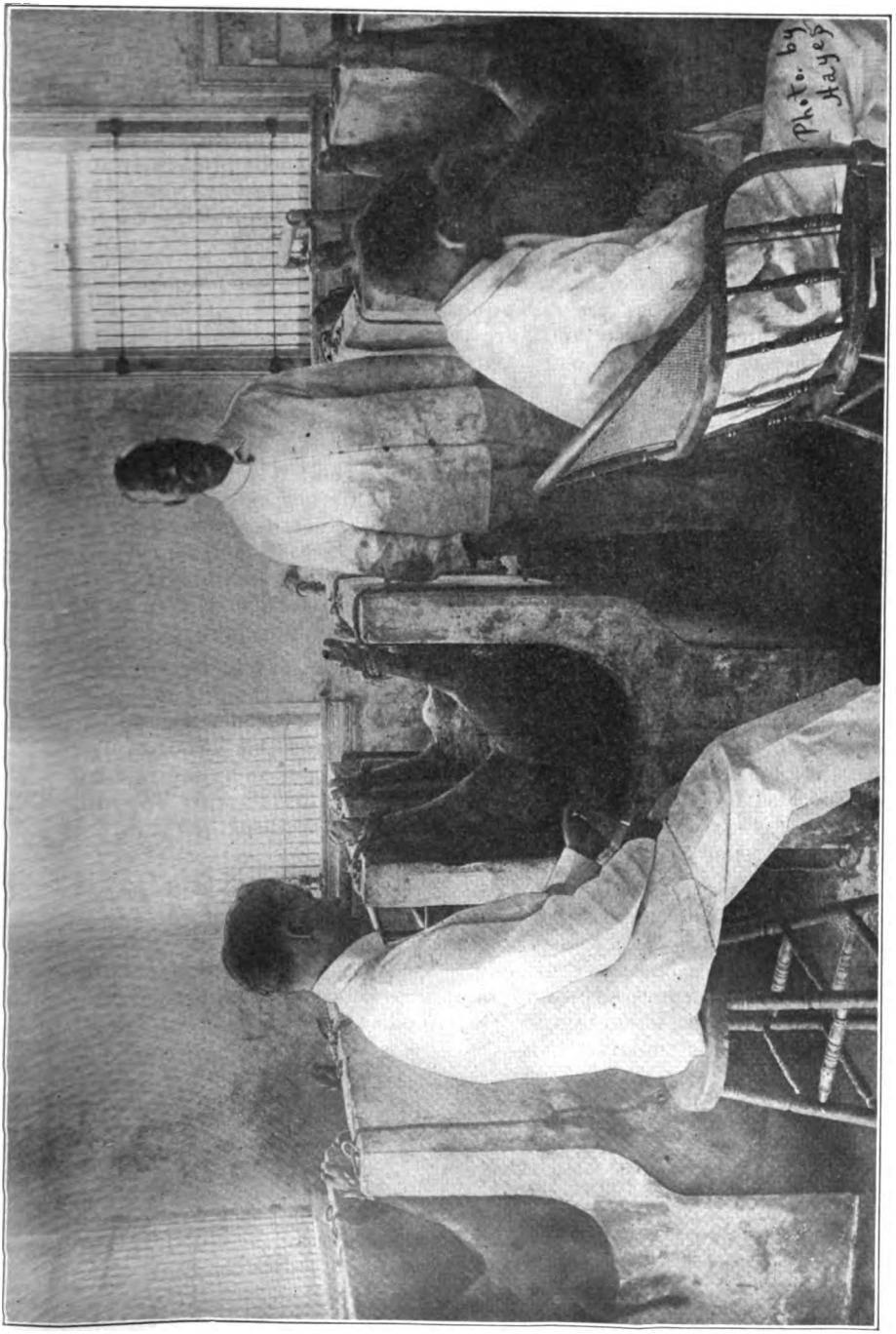

FIGURE 10.—Hyperimmunes being bled by tail.

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MORTALITY.

The mortality will vary in different localities and on different farms. When cholera first makes its appearance in a locality the per cent of deaths, as a rule, is higher than it is at the end of the outbreak. The same is also true in communities where cholera has appeared for a number of years in succession. The per cent of losses will range around fifty per cent in some localities; in other as high as ninety-five per cent. This depends on the virulency of infection and the susceptibility of the hogs.

As a rule hogs recovering from cholera are greatly depreciated in value. Unless the hogs are exceptionally valuable ones, it would be more economical to destroy and burn them when they have developed a well defined case of cholera.

ANTI-HOG CHOLERA SERUM.

In order to make potent anti-hog cholera serum, it is necessary to select a hog that is "immune" to cholera. This hog is one that has been treated with serum and virus at least twenty-one days, or one that has recovered from an attack of cholera. One attack of cholera confers life immunity. Into this "immune" hog ten cubic centimeters of virus are injected direct or indirect into the circulation for every pound of live weight. This hog is then known as a hyper-immune.

In the course of eight to ten days the hyper-immune is bled by the tail, taking as much blood as the hog will stand. As soon as the hog recovers from the effect of having a large quantity of blood removed from it, which is about a week, the hog is then bled again and this is continued until four bleedings have been made. Then the hog is re-hyperimmunized and bled four more times. This is continued until the tail becomes short, when the final bleeding is made by cutting the throat, and all of the blood is removed.

The blood from the tail and throat of the hyper-immunized hog is defibernated (the clot is removed) leaving the liquid portion of the blood, which is the serum. To this serum is added enough carbolic acid to make one-half of a one per cent solution. The acid is added as a preservative. This serum is a preventive to hog cholera and cannot produce hog cholera because it contains the anti-bodies which are antagonistic to the germs of hog cholera.

VIRUS.

The virus used to hyper-immunize the immune hog is secured by injecting a small amount of virus (the liquid portion of the blood) from an acute case of hog cholera into a susceptible hog, or by exposing a susceptible hog to hog cholera infection. When the hog has developed an acute case of cholera, the hog is bled by the throat and the blood is then defibernated. The virus or liquid portion of the blood is injected direct or indirect into the circulation of the immune hog.

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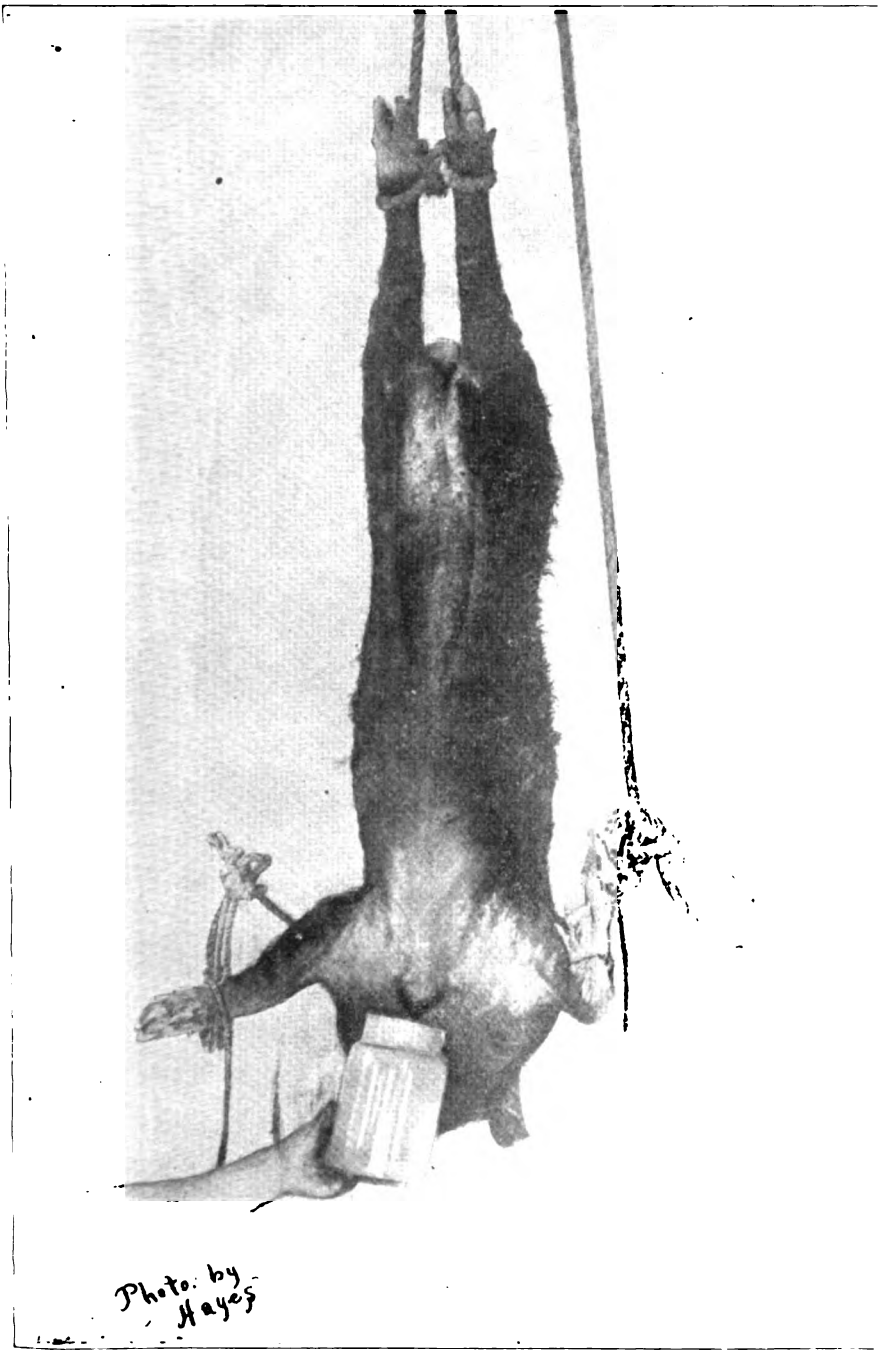

FIGURE 11.—Bleeding by throat for virus.

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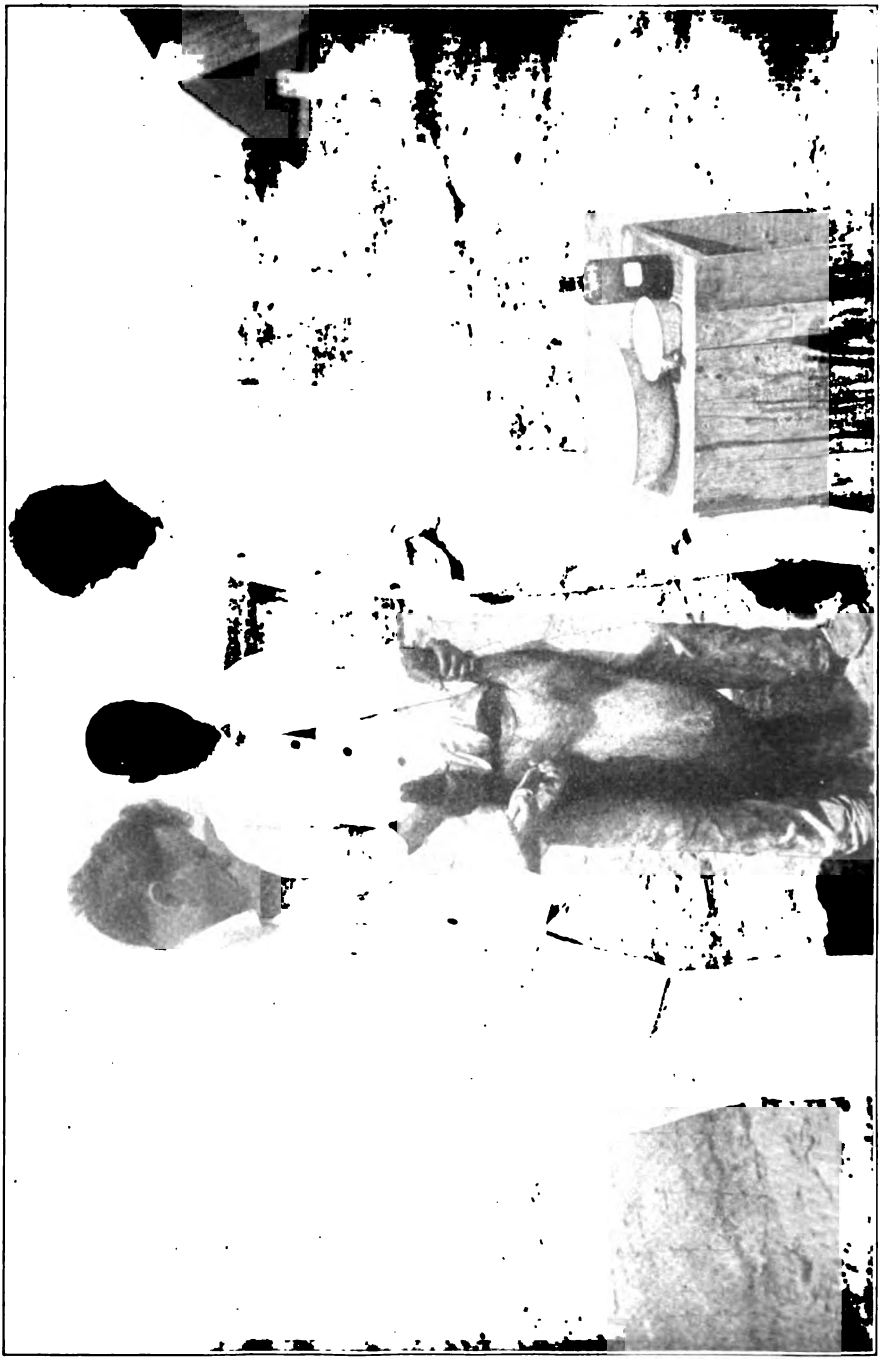

FIGURE 12.—One of the ways of vaccinating.

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ANTI-HOG CHOLERA SERUM.

(The only known preventive for hog cholera.)

There are thousands of dollars spent annually for so-called sure hog cholera "cures." Agricultural papers are full of very attractive advertisements of fake remedies. To spend money for such "fakes" is nothing less than throwing it away.

It would be well to bear in mind that all products advertised as "cures" for hog cholera are worthless; also that a large per cent of the serum and vaccines will not prevent hog cholera.

Anti-hog cholera serum, if properly prepared and administered will, without a doubt, prevent hog cholera but very little is claimed for it as a curative agent.

WAYS OF VACCINATING.

There are two ways by which hogs may be vaccinated with anti-hog cholera serum, the Serum Alone Method and the Serum Simultaneous Method. The Serum Alone Method consists of injecting the required amount of serum into the tissues of the hogs with a hypodermic syringe. The Serum Simultaneous Method consists of injecting the serum as in the Serum Alone Method, but at the same time a small amount of virus is injected.

The Serum Alone Method only confers immunity for a very short period, varying from four to eight weeks, whereas the Serum Simultaneous Method confers immunity, varying from a few months in very young pigs to life immunity in older hogs.

As there is considerable danger attached to the Serum Simultaneous Method, it is not safe to put this method of treatment into the hands of persons who have not had special training for this purpose. This is so because a small per cent of the hogs treated by this method develop hog cholera and die. This is so when the method is applied by men who have had long training and wide experience in using the serum and virus. We think it would be a great mistake to distribute the virus with the serum over the State to any one applying for it. If this was done we would expect to see the entire State sooner or later "fired" with hog cholera. There is no danger of producing hog cholera by using the Serum Alone Method, and for this reason we think it is the only method to place in the hands of the untrained.

The serum is sent direct to any one ordering it, with full directions for using. If the directions are followed closely good results will follow. It is always better, whenever possible, to have some one inject the serum who has at least seen it injected, if they have not done so themselves. Our advice would be to employ a graduate veterinarian when possible and have him inject the serum for you.

HOW AND WHEN TO USE SERUM.

The Serum Alone Method only gives temporary immunity lasting from four to eight weeks, an average of about six weeks. It is rather expensive to keep a herd of hogs immuned by his method. We believe it would be cheaper where a permanent herd is to be kept for breeding purposes

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FIGURE 18.—Injecting serum into loose tissues between foreleg and body.

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to use the Simultaneous or Double treatment. This would insure protection at all times to the foundation of the herd.

The owner of a herd of hogs should not delay any longer than possible in securing the serum and injecting his hogs when it becomes known that they have been exposed to cholera, or when it is known that cholera is in his community, if there is any possibility of the infection gaining entrance to his herd through any of the many channels of entrance.

When the serum is used shortly before or very soon after the hogs are exposed to cholera infection the per cent protected is often as high as a hundred, but usually ranges around 95 per cent. After cholera has gained entrance in a herd and a portion of the hogs are showing physical or thermal symptoms of cholera, the per cent saved of the remaining apparently well hogs will not be so high, but a good per cent of those showing no physical or thermal symptoms will be protected.

When a large number of hogs in a herd become sick and begin to die it is pretty safe to say that they are affected with hog cholera. Immediate steps should be taken to secure the serum and inject the remaining well hogs.

To inject the serum one must have a hypodermic syringe (preferably a 20 or 30 c.c. glass barreled one). This syringe should be sterilized by being boiled in water for fifteen or twenty minutes. Before using, the mouth of the serum bottle should be wiped off with a five per cent solution of carbolic acid and the serum then poured into the receptacle with a cover. Both the receptacle and cover should have been boiled in water for fifteen or twenty minutes and allowed to cool before pouring the serum into it. Keep the cover on all the time except when the serum is being poured into or taken from the receptacle. The hands of the person injecting the serum should be washed before beginning and kept clean all the time. Do not allow the syringe or needle to come in contact with soiled objects.

The serum is injected into the tissues either on the inside of the thigh or into the loose tissues between the foreleg and body. The needle is inserted perpendicularly to the depth of one-half or one inch, depending upon the size of the hog. The serum is then injected and the needle withdrawn. Before the needle is inserted the skin at the point selected should be washed with soap and water and then scrubbed with a reliable disinfectant, such as a five per cent solution of carbolic acid, lysol or creolin.

Hogs in infected herds showing a temperature above 104 degrees F. are considered to be affected with cholera. The hogs showing high temperatures should be given a double dose of serum; apparently well hogs in infected herds should be given more serum than hogs in non-infected herds. (See dose table.)

THE SERUM AS A CURE FOR HOG CHOLERA.

No claim is made that the serum will "cure" a well developed case of hog cholera. A small per cent of the hogs showing a temperature above 104 degrees Fahrenheit will, if given a large dose of serum, make

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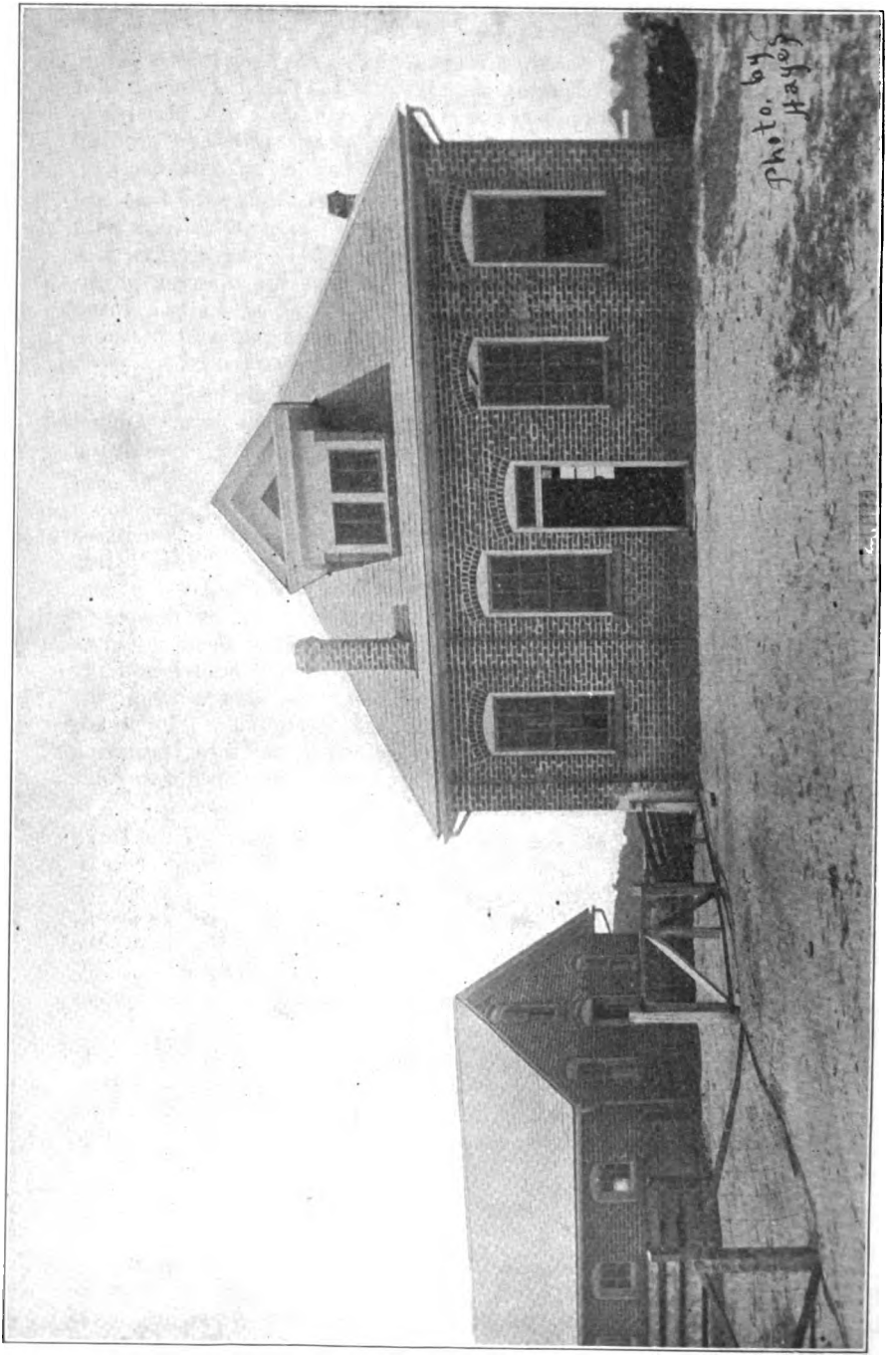

FIGURE 14.—The serum plant.

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a recovery. We believe the per cent of recoveries will justify the expense of the serum used.

VACCINATING INFECTED HERDS.

Do not fail to take the temperature of all hogs in infected herds. Those showing a temperature of 104 degrees or higher should be given a double dose of serum.

Never use the Simultaneous treatment in infected herds (they already have enough infection). Hogs injected with a protective dose of serum and left in infected lots or pens for three weeks will, in all probability, contract enough infection to produce the same immunity as those treated with the Simultaneous method. However, one can never be sure of this.

THE DOSE OF SERUM.

Care should be used in estimating the weight of every hog injected because the amount of serum to be used will depend on the weight of the hog and not on the age. Always be certain not to underestimate the weight; it is much better to overestimate than to underestimate. If the weight is underestimated and too small a dose of serum is given, the hog will not be protected from cholera. There is no danger in giving an overdose of serum; the larger the dose the more certain the protection.

Avoid turning the hogs into muddy, filthy or dusty lots after they are injected. It is better to keep them in a lot for several days until the puncture wound caused by the needle has had time to heal. If the wound becomes infected abscesses may follow. When abscesses form they should be opened and washed with an antiseptic solution.

A complete and accurate record should be kept by every farmer using the serum. He should record the number of hogs that have died from hog cholera at the time the serum is injected; also keep a record of the number of sick hogs in the infected lots; how many treated with serum; and the number of both treated and not treated that die. Don't fail to take the temperature of all hogs in an infected herd. Those that show a temperature of 104 degrees Fahrenheit are considered affected with hog cholera.

THE SERUM PLANT.

The North Carolina Department of Agriculture has erected and equipped a modern anti-hog cholera serum plant. It is the Department's purpose to make and distribute a potent serum to the farmers of the State at cost of production.

In 1911 the charge for the serum was two and one-half cents per cubic centimeter. This has been gradually reduced until it is now being distributed for one and one-quarter cents per cubic centimeter, the cost of production.

TESTED SERUM.

All serum should be tested for potency before it is used in the field. Serum sent out by this Department is tested in the following manner. The bleedings from the tail and the final bleeding by the throat of a number of hyperimmune hogs are thoroughly mixed, which is then

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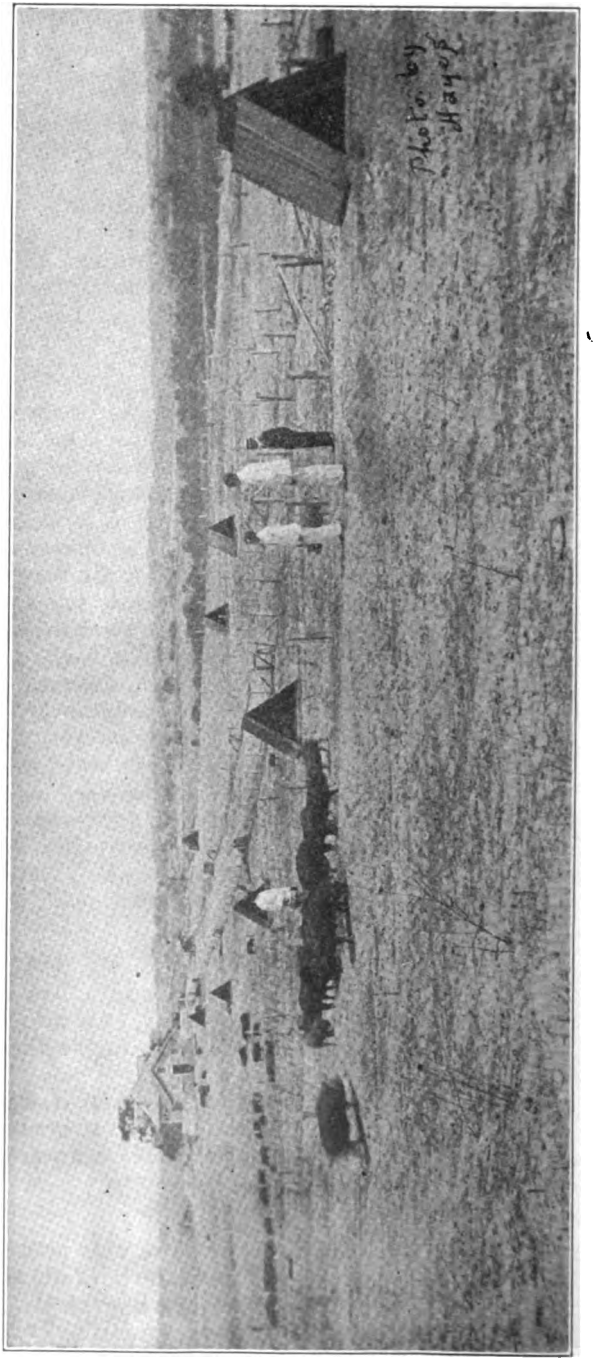

FIGURE 15.—South side of serum plant.

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tested on susceptible pigs. The test is made by injecting two cubic centimeters of virus into each of four susceptible pigs (25 to 35 pounds) preferably from the same litter. These pigs are then injected with different amounts of serum. No. 1 would get two cubic centimeters of virus and twenty cubic centimeters of serum; No. 2, fifteen cubic centimeters of serum and two cubic centimeters of virus. No. 3, ten cubic centimeters of serum and two cubic centimeters of virus; No. 4 would get two cubic centimeters of virus and no serum. If No. 4 dies within fifteen days and Nos. 1, 2, and 3 show no signs of sickness, we then know that the virus used was virulent and that the serum protected Nos. 1, 2, and 3 from what would have been a fatal dose of virus.

DIRECTIONS FOR ORDERING SERUM.

The serum will be shipped, by express, C.O.D., to any one ordering it, unless check or money order accompanies the order. Do not fail to give correct address.

Always state correctly the amount of serum wanted, or give the weight of each hog to be treated. If a hypodermic syringe is desired, state so in your order, otherwise it will not be sent. A twenty cubic centimeter glass barreled syringe will be sent at cost, $1.75, if ordered.

The serum will be shipped in the following size bottles:

30 c.c., 50 c.c., 100 c.c., 120 c.c., 150 c.c., 180 c.c., 200 c.c., 250 c.c., 500 c.c., 750 c.c., and 1000 c.c.,

The cost of the serum is one and one-quarter cents per cubic centimeter. No serum will be taken back; when the serum is placed in the express office it becomes your serum.

Address all communications for serum to the State Veterinarian, Department of Agriculture, Raleigh, N. C.

VACCINATION DOSES.

It requires more serum per pound of weight to "immunize" young pigs than is required to "immunize" older hogs.

	Cholera-free Herds.	Infected Herds.
Suckling pigs	5 to 10 c.c.	10 to 15 c.c.
25 to 50 pounds	20 c.c.	25 c.c.
50 to 100 pounds	25 c.c.	30 c.c.
100 to 150 pounds	30 c.c.	40 c.c.
150 to 200 pounds	40 c.c.	50 c.c.
200 to 250 pounds	50 c.c.	60 c.c.
250 to 300 pounds	60 c.c.	70 c.c.
300 to 350 pounds	65 c.c.	75 c.c.
350 to 400 pounds	70 c.c.	80 c.c.
All over 400 pounds	80 c.c.	90 c.c.

PENALTY FOR ALLOWING DISEASED HOGS TO RUN AT LARGE.

"If any person having swine affected with the disease known as hog cholera, or any other infectious or contagious disease, and discovering the same, or to whom notice of the fact shall be given, shall fail of neg-

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lect for five days to secure the diseased swine from the approach or contact with other hogs not so affected, by penning or otherwise securing and effectually isolating them, so that they shall not have access to any ditch, canal, branch, creek, river, or other watercourse which passes beyond the premises of the owners of such swine, he shall be guilty of a misdemeanor, and upon conviction shall be fined not exceeding fifty dollars or imprisoned not exceeding thirty days."—*Section 3297 of the Revisal of 1905 of North Carolina; 1889, ch. 173, sec. 1; 1891, ch. 67, secs. 1, 3; 1903, ch. 106; 1899, ch. 47.*

PENALTY FOR FAILURE TO PROPERLY DISPOSE OF CARCASSES OF ANIMALS DYING FROM INFECTIOUS DISEASES.

"If any hog or other animal shall die with the hog cholera or other infectious disease, and the owner thereof shall fail to burn or to so bury the same as to secure it from the reach or contact with other hogs or other domestic animals of value, or if he shall throw or place such hog or other animal in any ditch, canal, branch, creek, river, or other watercourses passing beyond his own premises, he shall be guilty of a misdemeanor and upon conviction shall be fined not more than fifty dollars or imprisoned not more than thirty days."—*Section 3298 of the Revisal of 1905 of North Carolina; 1889, ch. 173, sec. 2; 1891, ch. 67, secs 2, 3; 1903, ch. 106; 1899, ch. 47.*

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LEAF TOBACCO SALES FOR MAY, 1914

Pounds sold for producers, first hand	174,981
Pounds sold for dealers	33,257
Pounds resold for warehouse	2,360
Total	210,598

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THE BULLETIN

OF THE

NORTH CAROLINA

DEPARTMENT OF AGRICULTURE,

RALEIGH

Vol. 35, No. 8. AUGUST, 1914. Whole No. 199.

CORN SILAGE AND COTTON-SEED HULLS FOR FATTENING BEEF CATTLE

Good Steers Properly Fed Bring Permanent Improvement on the Farm.

PUBLISHED MONTHLY AND SENT FREE TO CITIZENS ON APPLICATION.

Entered at the Post-office at Raleigh, N. C., as second-class matter, February 7, 1901, under Act of June 6, 1900.

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*Assigned by the Bureau of Soils, United States Department of Agriculture.
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‡In coöperation with Bureau of Plant Industry, United States Department of Agriculture.

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LETTER OF TRANSMITTAL.

Hon. W. A. Graham,
Commissioner of Agriculture,
Raleigh, N. C.

Sir:—I submit herewith manuscript for a bulletin on *Corn Silage and Cotton-seed Hulls for Fattening Beef Cattle.* This important experiment was made on the Iredell Test Farm during the winter of 1913-1914, and should be considered a report of the progress of the work, as plans are made for continuing these and similar experiments on the Iredell Test Farm until the prominent questions relating to the fattening of beef cattle during the winter months have been thoroughly and carefully studied.

I recommend the publication of this report as the August Bulletin.

Very respectfully,
Dan T. Gray,
Chief in Animal Industry.

Approved for printing:
W. A. Graham,
Commissioner of Agriculture.

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SUMMARY STATEMENTS.

The lot of cattle fed cotton-seed meal and corn silage made only slightly larger gains than those fed cotton-seed meal and cotton-seed hulls. Lot 1 made an average daily gain of 1.62 pounds and Lot 2 1.63 pounds during the experimental period of 112 days.

The steers in Lot 1 were fed an average of 21.95 pounds of cotton-seed hulls per steer daily during the experimental period. The steers in Lot 2 were fed an average of 42.46 pounds of corn silage per steer daily during the experimental period. According to the gains made, this showed a relative feeding value of approximately one pound of cotton-seed hulls to two pounds of corn silage.

It required 1,352.2 pounds of cotton-seed hulls in conjunction with 458 pounds of cotton-seed meal to make 100 pounds gain, and 2,611.4 pounds of corn silage in conjunction with 458 pounds of cotton-seed meal to make 100 pounds gain. This shows that it takes, on the average, about two pounds of corn silage to replace one pound of cotton-seed hulls under the conditions of this experiment.

It cost $11.43 to make 100 pounds gain in the lot fed cotton-seed meal and cotton-seed hulls, and $10.92 in the lot fed cotton-seed meal and corn silage, the difference being 51 cents per hundred pounds in favor of the corn-silage-fed cattle.

When the steers were finished, those fed cotton-seed hulls for roughage were valued at $7.50 per cwt. and those fed corn silage $7.70 per cwt. This decision was corroborated by the slaughter data obtained at the abattoir. The silage-fed cattle were thicker and more uniformly covered with fat.

The comparative profit per steer in Lot 1 fed cotton-seed hulls for roughage, eliminating freight, cost of labor, and bedding, was $8.29 per steer. The comparative profit per steer in Lot 2 fed corn silage for roughage was $11.36 per steer, showing a difference of $3.07 in favor of the corn-silage-fed cattle.

The shipping data obtained on these cattle showed that the steers fed corn silage did not shrink any more than steers fed cotton-seed hulls under like conditions otherwise. The average net shrink per steer from Statesville, N. C., to Richmond, Va., was slightly less than 45 pounds.

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CORN SILAGE AND COTTON-SEED HULLS FOR FATTENING BEEF CATTLE

WORK CONDUCTED AT

IREDELL TEST FARM, STATESVILLE, N. C.

BY
R. S. CURTIS, L. W. SHOOK, F. T. MEACHAM.

INTRODUCTION.

A great deal of interest has developed recently in the winter feeding of beef cattle. This is due to two conditions: first, because of the desire to incorporate the fertilizing value of cotton-seed meal in the form of manure, and, second, to utilize cheap or unsalable feeds in the roughage part of the ration and in the bedding to add humus to the soil. There is thus a twofold reason for feeding cattle, either of which is of much greater importance than ordinarily considered. Experimental workers and farmers who have had experience will admit that under present conditions there is, many times, no profit in the winter cattle-feeding industry, excluding the value of the manure. The manurial benefit to the land, however, is considered to be of unquestionable value.

This brings up the problem of the most feasible plan to follow in preparing fattening cattle for the market. The southern farmer usually has a number of roughage feeds available, and with comparatively little effort others of value can be provided. Cotton-seed hulls is the standard roughage feed throughout the South, and while acceptable in many respects as a roughage feed, it must be purchased direct from the cotton-seed oil mills. It is generally admitted that the farmer should not purchase roughage feeds, although cotton-seed hulls can sometimes be used to advantage either as a whole or a part of the roughage ration.

One of the principal drawbacks to the use of cotton-seed hulls is the fact that they cannot be used in conjunction with cotton-seed meal for a sufficient length of time to put cattle in prime market condition. For this reason it is an important problem to determine whether a substitute can be profitably used, either as a whole or a part of the roughage ration. The following results were obtained from an experiment designed to determine the feasibility of the plan suggested.

LOCATION OF WORK.

The results of the work herein reported were obtained from two carloads of forty-eight grade Shorthorn steers fed on the Iredell Test Farm at Statesville, N. C. The results were obtained under the best of experimental conditions. The feeding was done by a competent man during the entire feeding period of four and one-half months.

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Work of this character in Iredell County is of unusual importance, owing to the natural conditions for cattle feeding and the great interest which was manifested in this experiment. At the close of the experiment a meeting was held to explain the results which had been obtained. Although an inclement day, a very acceptable number of farmers was present to learn the results and see the finished cattle.

FIG. 2. A Group of the Steers Fed Cotton-seed Meal and Cotton-seed Hulls.

The conditions in this and surrounding counties for winter cattle feeding are especially favorable because of the proximity to oil mills and the fact that an unusual amount of roughage feed is produced which is available both for feeding and bedding purposes. While the local markets for cattle are not the most desirable, easy access can be had to the best eastern markets.

OBJECTS OF EXPERIMENT.

The fundamental object of the experiment was to determine the comparative value of corn silage and cotton-seed hulls each in conjunction with a like amount of cotton-seed meal. This problem redivides itself into two sub-problems, the first being to determine the average daily and total gains made, the cost of same, and, second, the market value of the finished animals fed on the two rations in conjunction with cotton-seed meal.

The importance of this problem is not fully recognized by the farmer until his finished animals are offered for sale. The average farmer is usually not fully acquainted with market conditions. He is, therefore, unable to fully appreciate the value of a feed which will finish cattle in prime condition and enable him to command remunerative prices. Sufficient importance is not attached to the difference between producing gain on an animal and obtaining a wide margin, that is, the difference between the buying and selling price. Some feeds make acceptable gains, but do

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not produce a desirable finish, upon which the amount of margin depends almost wholly. These factors thus briefly explained are the important objects of the work.

PLAN OF WORK.

The experiment was planned so that every condition would be the same in each lot of cattle except the variation in the roughage rations, which was the real nucleus of the experiment. The cattle were divided into six pens of eight steers each. Three pens of cattle were fed corn silage and three pens cotton-seed hulls, thus making a car-load in each lot. Two pens of the corn-silage-fed cattle and two pens of the cotton-seed-hulls-fed cattle were fed on the south side of the cattle barn. The third pen of corn-silage-fed and cotton-seed-hulls-fed cattle were fed on the north side of the barn. All shelter and exposure conditions were therefore exactly the same.

The cattle were divided into the two lots of twenty-four head each as equally in weight, quality, and condition as possible. The preliminary rations were the same for each lot. This period extended from October 15, 1913, to November 2, 1913, inclusive, the total preliminary period being 19 days. During this time the roughage ration remained the same for all the cattle, and the cotton-seed meal was increased uniformly toward the standard or experimental ration, which was 7.5 pounds per animal daily.

TABLE 1—KIND AND AVERAGE QUANTITY OF FEEDS GIVEN PER STEER DAILY DURING THE EXPERIMENTAL PERIOD.

Period.	Lot 1 (24 Steers).	Lot 2 (24 Steers).
November 3, 1913, to February 22, 1914—112 Days.	7.45 pounds cotton-seed meal... 21.95 pounds cotton-seed hulls...	7.45 pounds cotton-seed meal. 42.46 pounds corn silage.

The foregoing table brings out clearly the method of comparison. The daily cotton-seed meal ration is the same for each lot, the only variation being in the amount of roughage feeds fed as indicated.

At the beginning of the final or experimental period one lot of cattle was put on cotton-seed hulls and the other lot on corn silage. This marked the date of comparative results herein given. The increase in cotton-seed meal was continued until November 15, when all the cattle were placed on the standard ration of 7.5 pounds per animal daily. The ration of each lot was increased to 8 pounds on January 26, 1914, just four weeks prior to the close of the experiment. With the exception of the last three days of the feeding period the rations were continued as outlined. On February 23 they were changed somewhat to prepare the steers for shipment. This consisted in a reduction of the cotton-seed meal and the introduction of cotton-seed hulls in the ration of the corn-silage-fed cattle.

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The comparative results as given in this bulletin include the data from November 3, 1913, to February 22, 1914, inclusive, making the total experimental period 112 days. The data given in the financial statements

FIG. 3. A Group of the Steers Fed Cotton-seed Meal and Corn Silage.

includes all items of expenditure from the time the cattle were loaded for shipment to the feed lot until they were loaded and turned over to the commission buyer at the local shipping station.

LENGTH OF EXPERIMENT.

The length of the experiment has been treated elsewhere in considerable detail. The preliminary period was 19 days, the experimental period 112 days, and the period preparatory to shipment 3 days, making a total feeding period of 134 days. The most important point to bring out in this connection is the fact that the experimental period was not of sufficient length to bring out the characteristic difference in the value of the two roughage feeds used.

Former experiments* show that for about 100 days the results obtained from using cotton-seed hulls and corn silage in conjunction with cotton-seed meal are not greatly different. It is after the expiration of the one-hundred-day period or thereabouts that marked differences in the value of these feeds usually occur. Even under the conditions of this experiment, however, there was a marked difference in the results, but more especially in the value of the finished animals. The difference in the gains was not as great as would have been likely had the feeding been continued for a longer period. The results under the conditions of the experiment were not materially different than anticipated.

*N. C. Exp. Sta. Bulletins, 218-222.

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KIND OF STEERS USED.

The steers used in this work were purchased in the western or beef cattle producing section of this State. They were classed as 900-pound feeders. When taken from the pasture in the mountains they weighed slightly under 920 pounds per head. The steers were an average grade of 900-pound feeders usually secured in this State, there being a moderate variation in weight and quality. When the cattle were divided these qualities were apportioned equally in each of the two lots fed cotton-seed hulls and corn silage. The cattle were dehorned grade Shorthorns, and reasonably uniform in weight, quality, and condition at the beginning of the feeding experiment.

SHELTER AND WATER SUPPLY.

The cattle were fed in a closed barn with a lean-to shed on the south side, as shown in the illustration. Each of the stalls, including both the barn and shed portion, was twenty feet wide and twenty-six feet long. The feed troughs extended entirely across the end of the stalls adjacent to the alleyway, making two and one-half feet of feeding space for each

FIG. 4. Barn in Which Steers Were Fed.

steer. Both the steers and the manure were kept under cover the entire time except during the preliminary period in which the steers were left in the pasture during the daytime. The only exposure was the small amount of open space at each end of the shed and on the south side of same where water was provided.

The water was furnished from that collected from the barn roof and from a well, from which it was pumped by a gasoline engine. The cattle had water before them at all times. This is a very important matter both for the farmer and the experimental worker. Cattle fed cotton-

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seed hulls should have special attention, owing to the dry, undigestible nature of this roughage feed. The writers desire to emphasize the necessity of a plentiful and regular water supply for steers, especially since the idea is prevalent that cattle need only a limited amount of water at certain times in the day. Better gains will always be secured when the steers have free access to water.

BEDDING MATERIAL.

The bedding material used consisted of leaves, wheat straw, and corn stover. A sufficient quantity was used to keep the cattle reasonably clean and conserve the liquid manure. Bedding is rather difficult to obtain in many instances for winter cattle feeding work. For this reason, and the fact that the manure can be so much better saved, it is advisable to feed entirely under cover, with the exceptions following. Work is under way in sandy sections of the State to determine the feasibility of feeding cattle on the land where the manure is to be applied. *A brief summary of this work has just been published. It is impossible to follow this practice in the clay sections, however, because of tramping and puddling the soil.

In this feeding experiment there was no waste roughage, so that the entire amount of bedding was supplied especially for the purpose. When corn stover is fed, a large quantity of the coarser material not eaten by the cattle can be utilized for bedding purposes. These cattle were bedded on the average about once each week. During bad weather material was supplied at shorter intervals. During the first part of the work leaves were used largely. During the last part wheat straw and corn stover were used.

VALUATION OF FEEDS.

A standard market value was placed on each of the feeds used. The valuations given include the cost of delivery to the farm barn. The cotton-seed meal was rated at $27.75 per ton, the cotton-seed hulls at $7.50 per ton, and the average valuation of corn silage was placed at $3.50 per ton. The latter figure fixing the value of corn silage may be too high under some conditions in the State and too low in others. This valuation was fixed as an average for the whole State.

METHOD AND TIME OF WEIGHING CATTLE.

In the financial statements the mountain weights of the cattle are used for making the calculations on the initial cost. The final weight is the same as that used in the discussion of the experimental results.

In the beginning of the experimental period the cattle were weighed on three consecutive mornings before being fed and watered, and the average of these three weights taken for the initial experimental weight.

*N. C. Exp. Sta. Circular-Letter.

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The monthly weights and the final experimental weights were made always under normal conditions. The cattle were weighed each morning as nearly the same time as possible before any feed or water had been given.

METHOD OF FEEDING.

When the cattle first arrived at the farm they were turned on a small pasture, where they remained in the daytime during the preliminary period. After this period of nineteen days they were placed in the barn with eight steers in each of six pens and fed two equal feeds regularly each morning and evening. The roughage was given in moderately large quantities and increased gradually until a full feed of corn silage and cotton-seed hulls were being fed. This consisted on the average during the experimental period of 21.95 pounds of cotton-seed hulls and 42.46 pounds of corn silage. This is about the proportion in which these two feeds are usually given in practical feeding work.

TABLE 2—AVERAGE DAILY AMOUNT OF COTTON-SEED MEAL, COTTON-SEED HULLS AND CORN SILAGE FED PER STEER DAILY BY 28-DAY PERIODS, INCLUDING THE PRELIMINARY AND EXPERIMENTAL PERIOD.

Date Periods.	Cotton-seed Meal.		Cotton-seed Hulls.		Corn Silage.	
	Lot 1.	Lot 2.	Lot 1.	Lot 2.	Lot 1.	Lot 2.
19 days	2.20	2.20	*11.67	.....	†13.01	14.80
28 days	6.79	6.79	22.54	.....	.....	38.21
28 days	7.50	7.50	22.47	.....	.....	41.74
28 days	7.50	7.50	20.89	.....	.....	45.00
28 days	8.00	8.00	20.39	.....	.....	44.80

*Fed two and one-half days. †Fed sixteen and one-half days.

The cotton-seed meal was fed first at the rate of 1 pound per animal daily, and increased gradually until the standard ration of 7.5 pounds per steer daily was reached. In both cases the cotton-seed meal was fed, mixed with the cotton-seed hulls and corn silage. The roughage feeds were placed in the troughs first, after which the meal was spread over them and mixed evenly and thoroughly. Special attention is called here to the necessity of mixing the cotton-seed meal and roughage feeds thoroughly. This will prevent some steers from getting more than their share of the meal, which may thus cause cotton-seed meal sickness or an uneven finish. Thorough mixing is an inducement for steers to eat all of their roughage, besides furnishing in each case a very desirable dilutent for the cotton-seed meal. Successful feeding of cotton-seed meal depends on two factors: First, the meal must be fed in small quantities in the beginning and gradually increased; second, it must be thoroughly mixed with coarse feeds such as those used in these experiments.

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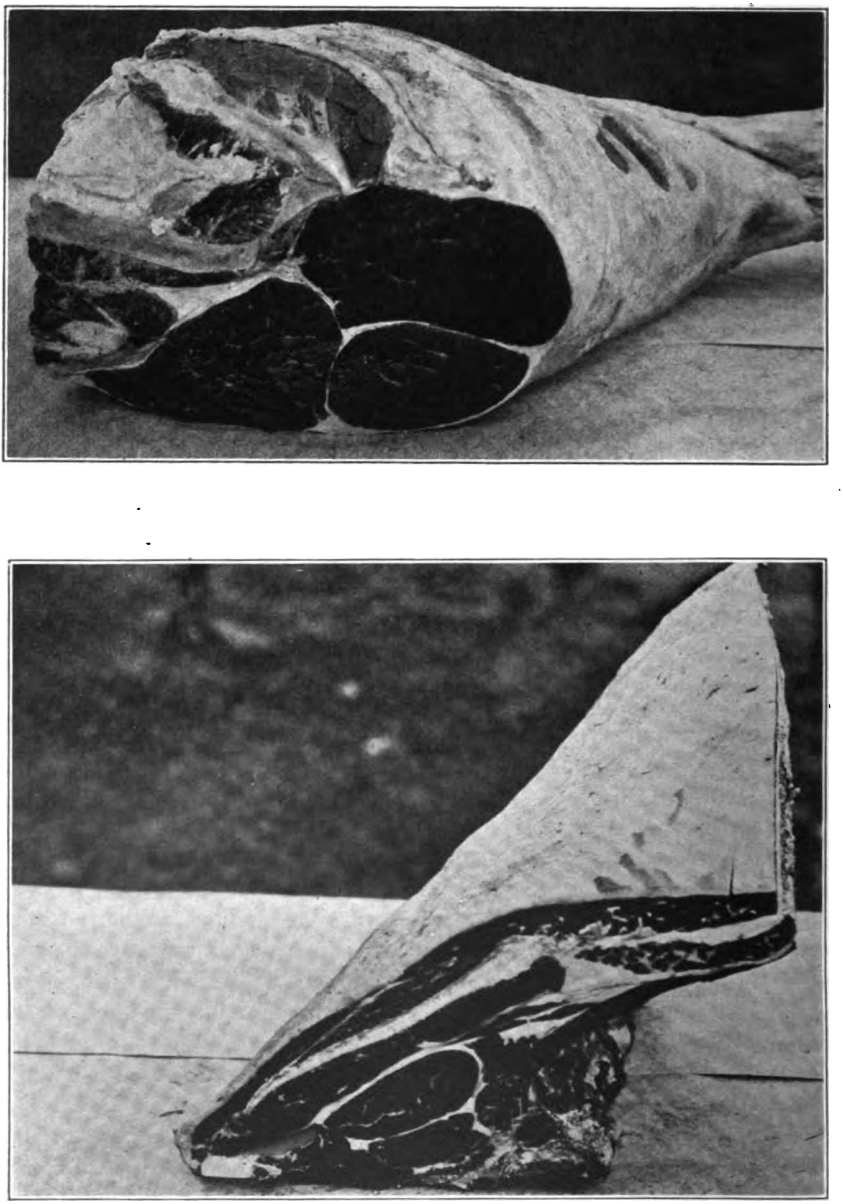

FIG. 5. The Condition of the Round and Rib of a Representative Steer Taken from Lot 1 at Beginning of Experiment.
Ration, Cotton-seed Meal and Cotton-seed Hulls.

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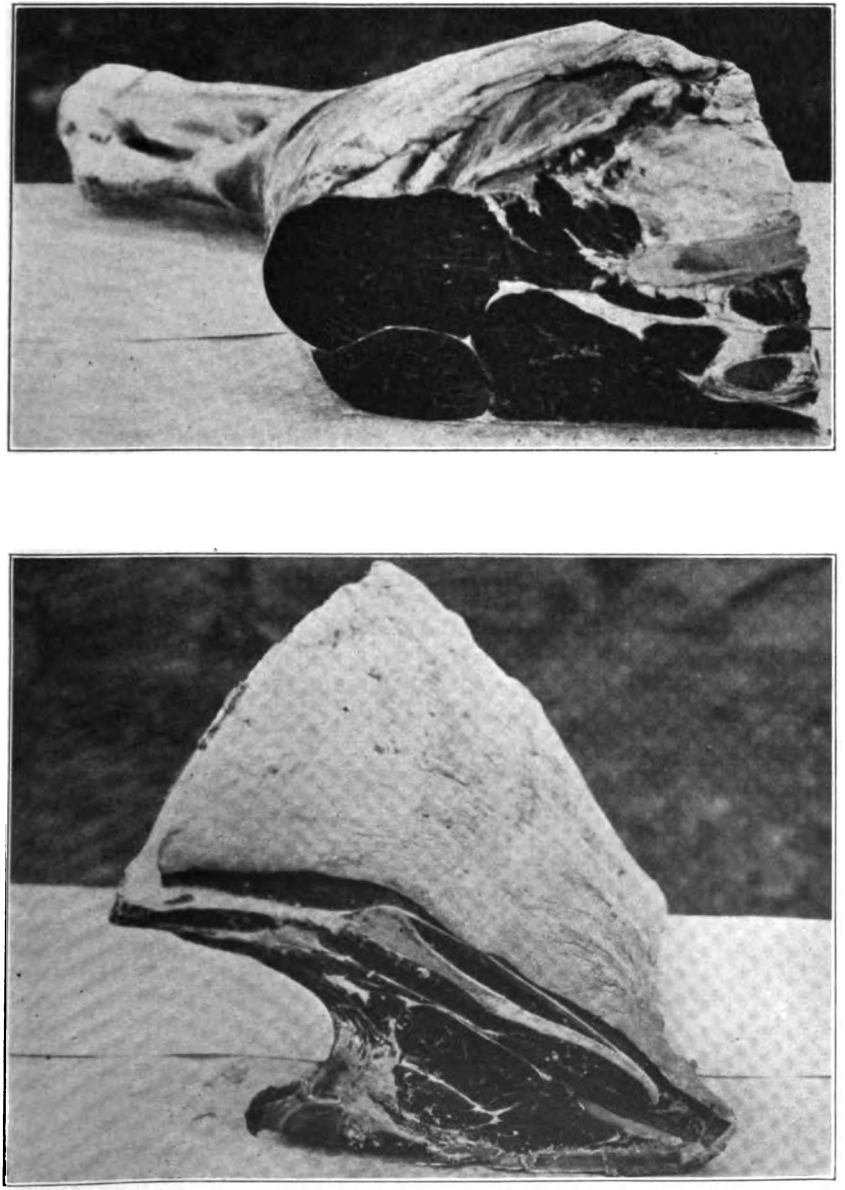

FIG. 6. The Condition of the Round and Rib of a Representative Steer Taken from Lot 2 at Beginning of Experiment.
Ration, Cotton-seed Meal and Corn Silage.

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DISCUSSION OF RESULTS.

In comparing the figures on the comparative profit per steer in each lot, it should be kept clearly in mind that only the cost of the steers, the cost of feed, and selling price are considered. The freight, labor, bed-

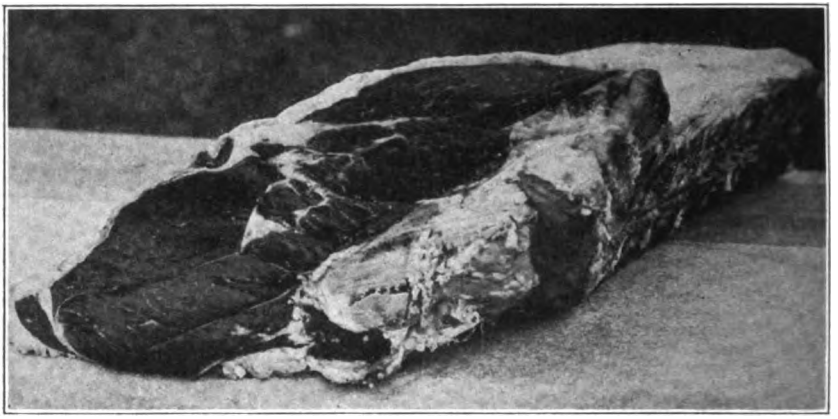

FIG. 7. The Condition of the Loin of a Representative Steer Taken from Lot 1 at Beginning of Experiment.
Ration, Cotton-seed Meal and Cotton-seed Hulls.

ding, and manure are all eliminated from this discussion. Since this is a determination of the comparative cost, valuation, and profit of the finished steers, these items are all eliminated to avoid confusion. This is customary in experimental work of this kind. Even though these items

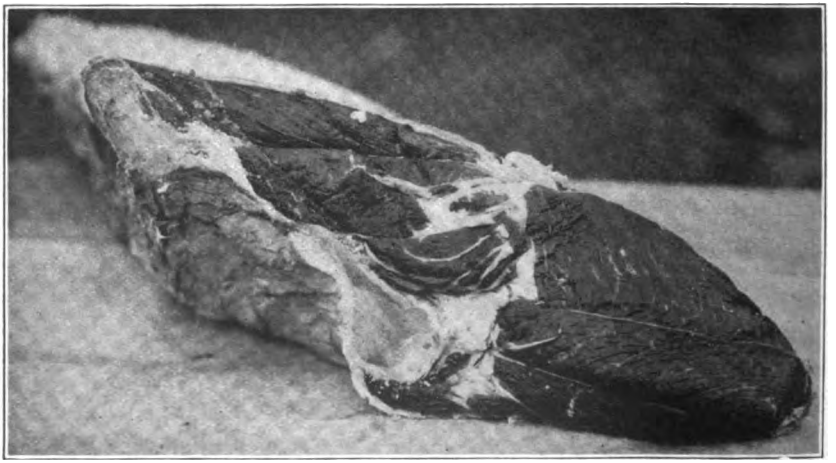

FIG. 8. The Condition of the Loin of a Representative Steer Taken from Lot 2 at Beginning of Experiment.
Ration, Cotton-seed Meal and Corn Silage.

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were included, the comparative results would be the same. However, the total profit per steer would be reduced. The final results in either case lead to the same conclusions.

In the financial statements all items of expense are included from the time the cattle were loaded in the mountains until they were loaded for shipment to the final consuming market. The only difference in these two statements, that is, the experimental data and the financial statement, is that the first is comparative and the second absolute. The experimental statements show what would result if a certain practice was followed on the farm, while the financial statements show what actually occurred in this particular experiment from a practical standpoint.

All of the fundamental data obtained during the experimental period are summarized in the following table. The value of the cattle at the beginning of the experiment was the same, while at the close there was a difference of 20 cents per cwt. affixed by three parties in close touch with market conditions. The initial weight of the cattle was practically the same, while there was a variation of only three-tenths of a pound in the average total gain per steer.

TABLE 3—SUMMARY OF COMPARATIVE RESULTS OBTAINED FROM FEEDING BEEF CATTLE.

	November 3, 1913, to February 22, 1914, Inclusive—112 Days.	
	Lot 1—24 Steers.	Lot 2—24 Steers.
	Cotton-seed Meal and Cotton-seed Hulls.	Cotton-seed Meal and Corn Silage.
Initial value per cwt.	$ 5.75	$ 5.75
Average initial weight, pounds	882.4	883.8
Average final weight, pounds	1,064.0	1,066.0
Total gain per steer, pounds	181.6	182.2
Average daily gain per steer, pounds	1.62	1.63
AVERAGE DAILY FEED PER STEER IN POUNDS.		
Cotton-seed meal	7.45	7.45
Cotton-seed hulls	21.95	-------
Corn silage	-------	42.46
AVERAGE AMOUNT OF FEED USED PER HUNDRED POUNDS GAIN.		
Cotton-seed meal	458.8	458.0
Cotton-seed hulls	1,352.2	-------
Corn silage	-------	2,611.4
COST OF FEED, VALUATION OF STEERS AND PROFIT.		
Cost of feed per cwt. gain	$ 11.43	$ 10.92
Valuation of steers per cwt.	7.50	7.70
Profit per steer (comparative)	8.29	11.36
Profit per steer, all expenses included (per financial statement)	.64	3.78
Average profit per steer, exclusive of manure	9.19	
Average profit per steer, including manure	11.84	

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FIG. 9. The Interior of a Slaughtered Carcass from Lot 1 at the Close of the Experiment.
Ration, Cotton-seed Meal and Cotton-seed Hulls.

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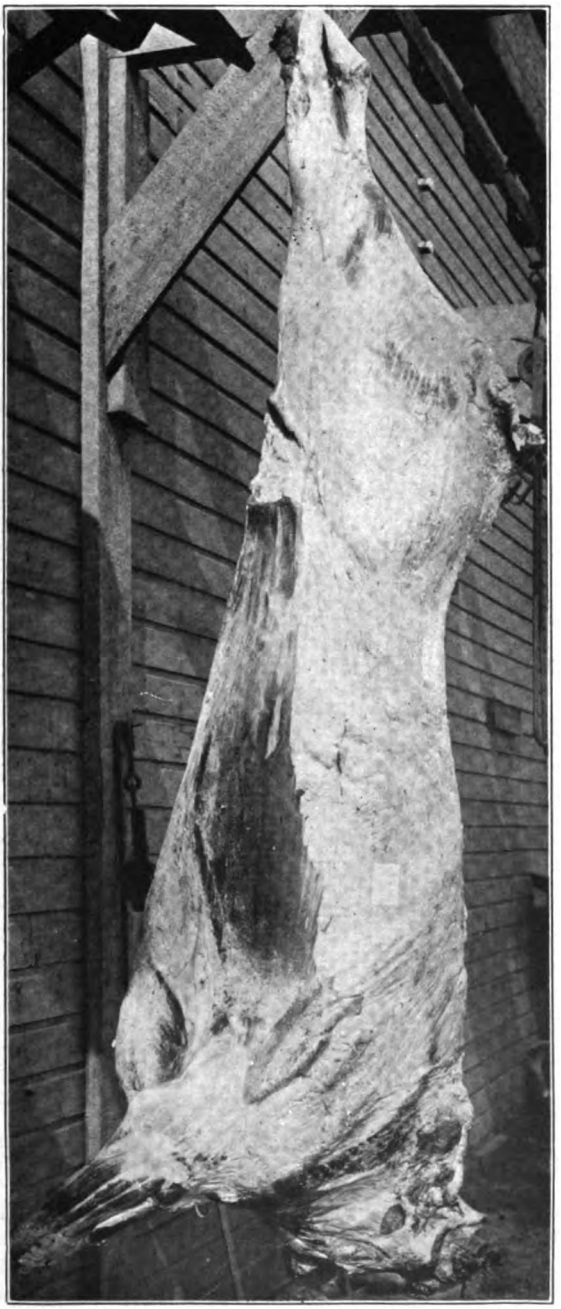

FIG. 10. The Exterior of a Slaughtered Carcass from Lot 1 at the Close of the Experiment.
Ration, Cotton-seed Meal and Cotton-seed Hulls.

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One important factor brought out was the relation between cotton-seed hulls and corn silage for steer feeding purposes. From the experiment it is shown that two pounds of corn silage will replace one pound of cotton-seed hulls. From these figures corn silage can be charged at $4 per ton against steers when cotton-seed hulls sell at $8 per ton, which was about the average price paid this year by most of the feeders in the State. Under these conditions the feeder would still have the advantage of getting the extra quality and finish obtained from the use of corn silage. A difference of 20 cents per cwt. would mean an approximate increased profit of $50 per car on every load of steers fed. When cotton-seed hulls can be purchased for less than $8 per ton these figures would be altered to the extent of the difference in the price of the hulls.

The cost per hundred pounds gain on the corn-silage-fed cattle was 51 cents less than on the cattle fed cotton-seed hulls. The difference in cost is not as great as ordinarily obtained in feeding steers under these conditions. The longer the feeding period in an experiment of this character usually the greater the difference in the average cost per hundred pounds gain. The profit per steer was $3.07 more on the cattle fed corn silage than those fed cotton-seed hulls. The relative difference only should be considered in studying these latter figures, as freight, labor, and bedding are not charged against the cattle.

AVERAGE DAILY GAINS DURING EXPERIMENTAL PERIOD.

The following table shows the gains by months of the two lots of steers fed cotton-seed hulls and corn silage. The average of one of the three pens of corn-silage-fed cattle was very low the fourth month. This makes the average for the lot during the fourth month less than the average for the lot on cotton-seed hulls. This is an unusual condition. However, the fault was not with the entire lot of corn-silage-fed cattle. The two other pens in this lot made normal gains during the fourth month. The almost inappreciable gain of the one pen reduces the average to .17 pounds less than the average for the lot of cattle fed cotton-seed hulls. The average gain for the whole period of four months is slightly more for the corn-silage-fed steers.

TABLE 4—AVERAGE DAILY GAIN PER STEER BY MONTHS DURING THE EXPERIMENTAL PERIOD.

November 3, 1913, to February 22, 1914, Inclusive—Period of 112 Days.	Average Daily Gain per Steer.	
	Lot 1.	Lot 2.
First month	1.86	1.73
Second month	1.72	1.96
Third month	1.82	1.90
Fourth month	1.09	.92
Average	1.62	1.63

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Former experiments* show that if cattle are fed longer than four months under the conditions which existed in this experiment the corn-silage-fed cattle will continue to gain and increase in value for thirty to sixty days longer, while those fed cotton-seed hulls will decrease materially in gains at this stage, and consequently in market value. Market conditions, however, made it necessary to dispose of these cattle before the expiration of the full experimental period.

VALUATION OF CATTLE.

The entire number of cattle was sold for $7.60 per cwt. at the farm, weighed up after twelve hours yarding from feed and water. The valuations placed on each lot of twenty-four cattle was $7.50 per cwt. for the cotton-seed-hulls-fed cattle and $7.70 per cwt. for the corn-silage-fed

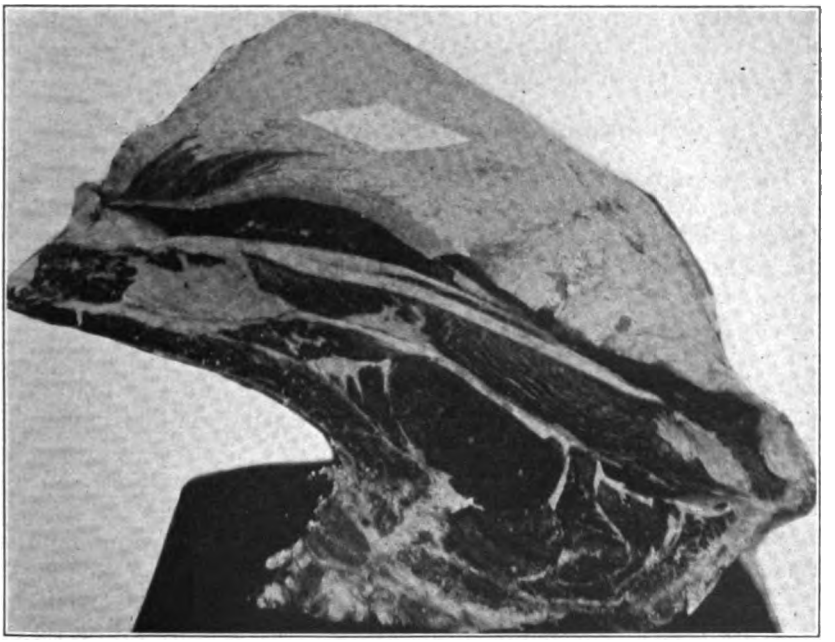

FIG. 11. The Condition of the Rib Cut Taken from a Steer in Lot 1 at Close of Experiment.
Ration, Cotton-seed Meal and Cotton-seed Hulls.

cattle. This difference was clearly apparent to all parties who saw them. The difference in price was established by three parties in close touch with market conditions.

The corn-silage-fed cattle were in better condition at the time they were sold, having a thicker, smoother, and more uniform distribution of fat. All outward indications of condition showed the corn-silage-fed

*N. C. Exp. Sta. Bulletins, 218-222.

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cattle to be in much better market condition. The cotton-seed-hulls-fed cattle did not show the sleek, smooth condition of skin and hair characteristic of well-finished animals. The supposition that cattle fed corn silage shrink abnormally in transit was not borne out by the data obtained on these steers. While the cattle were not divided in the cars the same as they were fed in the pens, the average net shrink was only 45 pounds per head between Statesville, N. C., and Richmond, Va. Considering that they were on the road sixty hours, a lighter shrink would not have been anticipated even on cattle fed entirely on dry roughage feed.

COMPARATIVE FINISH OBTAINED.

At the time these cattle were placed on feed one representative steer was taken from each lot and slaughtered to determine the condition of the animals. This was for the purpose of getting photographs and also for making a study of the admixture of flesh and fat. The condition of these two animals in this respect is brought out in the table descriptions and photographs of the cuts herein shown.

INITIAL AND FINAL SLAUGHTER DATA.

The two representative steers used to determine the initial slaughtered condition of the two lots of cattle weighed 1,820 pounds after a drive of 17 miles to Asheville, N. C., where they were slaughtered. After arriving at Asheville, Steer 1 weighed 820 pounds and Steer 2 weighed 890 pounds, or a total of 1,710 pounds. This showed a total shrink of 110 pounds from the farm to the slaughter-pens.

Steer 1 was blocky and in average condition of flesh. The animal was reasonably representative of the steers in Lot 1 fed cotton-seed meal and cotton-seed hulls. Steer 2 was somewhat more rangy, with less condition than Steer 1. This favored condition, however, is always provided in an experiment where it is necessary to deal with comparisons. While an average of these dressing percentages was used, the steer representing the cotton-seed-hulls-fed cattle had the advantage in the beginning over the one representing the corn-silage-fed cattle.

These two steers were slaughtered on November 8, the day following their arrival at the slaughter-house. This was five days later than the inauguration of the experimental work at the State Test Farm. The dressing percentages are based on the live weights taken the same morning the steers were slaughtered. Before slaughtering, the judges of these animals made a difference of one-fourth of a cent per pound in favor of Steer 1. After slaughtering, however, there was a greater difference than anticipated, owing to the greater amount of outside and internal fat on Steer 1. The meat of both steers had a bright red color and a good texture. However, Steer 1 was considered to be worth one-half cent per pound more live weight than Steer 2, owing largely to the amount and condition of the fat covering.

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The finished cattle when judged alive in the feed lots just prior to shipment showed the corn-silage-fed steers to be fully 20 cents per hundred better than the cotton-seed-hulls-fed steers. This was borne out by the examination made at Jersey City, N. J., where one car-load of the cattle was slaughtered. The other load of steers was sold to local butchers in Richmond, Va., so that accurate slaughter data could not be obtained. The corn-silage-fed cattle were thicker and more uniformly covered than those fed cotton-seed hulls. The illustrations show a more uniform distribution of fat, both on the interior and exterior of the sides. The outside fat is thicker, and there is a better marbled condition.

TABLE 5—DRESSING PERCENTAGE OF STEERS AT BEGINNING AND ENDING OF EXPERIMENT.

	Lot 1—Cotton-seed-hulls-fed Cattle.			Lot 2—Corn-silage-fed Cattle.		
	Live Weight.	Dressed Weight.	Average Dressing Percentage.	Live Weight.	Dressed Weight.	Average Dressing Percentage.
Average dressing percentage of two steers at beginning of experiment	850 800	435 427	52.24	800 850	427 435	52.24
Average dressing percentage of steers in each lot at close of experiment	33,310	18,164	54.53	12,700	7,164	56.41

The average dressing percentage of the twelve cattle fed on cotton-seed hulls was taken with nineteen other steers with which they were shipped from Richmond to Jersey City. These steers were of practically the same grade and quality as the twelve steers with which they were sold and weighed. The twelve steers fed on corn silage were weighed together alive, and when dressed, so that the average dressing percentage given is exact for this lot.

COMPARATIVE PRICES RETURNED FOR FEEDS USED.

It is interesting and instructive information to know the prices returned for certain feedstuffs when marketed through farm animals. The following table shows the prices obtained in this work when feeds are charged at varying prices. The figures written in italics indicate the market prices charged in this work and the prices returned for supplementary feeds under these conditions.

In other sections of the State where the prices of feeds vary somewhat these figures will enable the reader to approximate the results which could be obtained in cattle feeding. In all cases the feeds returned more than their estimated market value. Charging cotton-seed hulls at $7.50 per ton, the cotton-seed meal returned $30.34 for each ton fed. When

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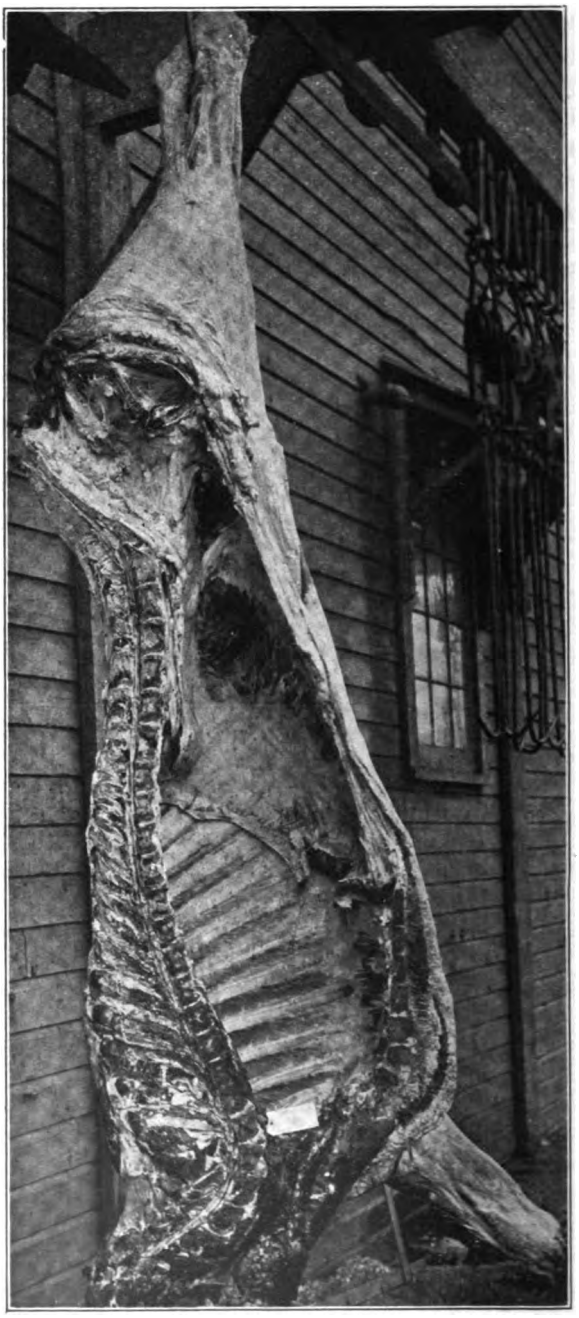

FIG. 12. The Interior of a Slaughtered Carcass from Lot 2 at Close of Experiment.
Ration, Cotton-seed Meal and Corn Silage.

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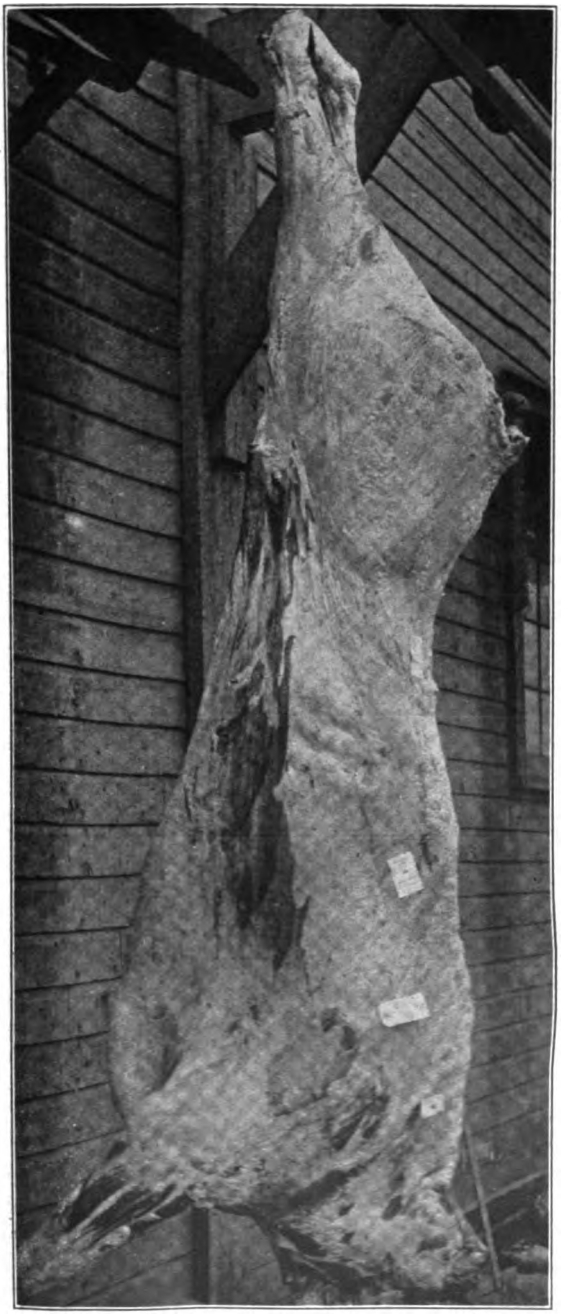

FIG. 13. The Exterior of a Slaughtered Carcass from Lot 2 at Close of Experiment.
Ration, Cotton-seed Meal and Corn Silage.

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cotton-seed meal was charged at $27.75 per ton, the cotton-seed hulls returned $8.38 per ton. When corn silage was charged at $3.50 per ton, the cotton-seed meal returned $37.71 per ton. Likewise when the cotton-seed meal was charged at $27.75 per ton, the corn silage returned $5.25 per ton. All of these figures are exclusive of the manurial value of the feeds.

TABLE 6—COMPARATIVE PRICES RETURNED FOR EACH TON OF THE VARIOUS FEEDS USED WHEN MARKETED THROUGH STEERS.

		Market Price of Feed Per Ton.	Price Returned for Each Ton of Feed.
Lot 1.	Price returned for each ton of cotton-seed meal when fed with cotton-seed hulls at different market prices.	Cotton-seed hulls—	Cotton-seed meal—
		$ 6.00	$ 34.76
		7.50	30.34
		9.00	29.92
	Price returned for each ton of cotton-seed hulls when fed with cotton-seed meal at different prices.	Cotton-seed meal—	Cotton-seed hulls—
		25.00	9.31
		27.75	8.38
		30.00	7.61
Lot 2.	Price returned for each ton of cotton-seed meal when fed with corn silage at different prices.	Corn silage—	Cotton-seed meal—
		3.00	40.56
		3.50	37.71
		4.00	34.86
	Price returned for each ton of corn silage when fed with cotton-seed meal at different prices.	Cotton-seed meal—	Corn silage—
		25.00	5.73
		27.75	5.25
		30.00	4.85

APPLICATION OF RESULTS.

The results of an experiment of this nature are of great importance to the farmer who expects to cater to a discriminating market. Feeders who handle native cattle, or feed in less than car-load lots, cannot use corn silage as economically as the type of feeder formerly described. This is largely because local markets will not pay for extra quality and finish such as that obtained with corn silage.

Where good, thrifty, high-grade steers are fed, such as those for which a premium is paid on a central market, corn silage from the results of this and other experiments can be used with economy and profit.* This experiment, in conjunction with a number of others carried on by the writers, shows that corn silage is the best supplementary feed to use with cotton-seed meal. The reasons why are explained elsewhere in detail in this bulletin.

*N. C. Exp. Sta. Bulletins, 218-222.

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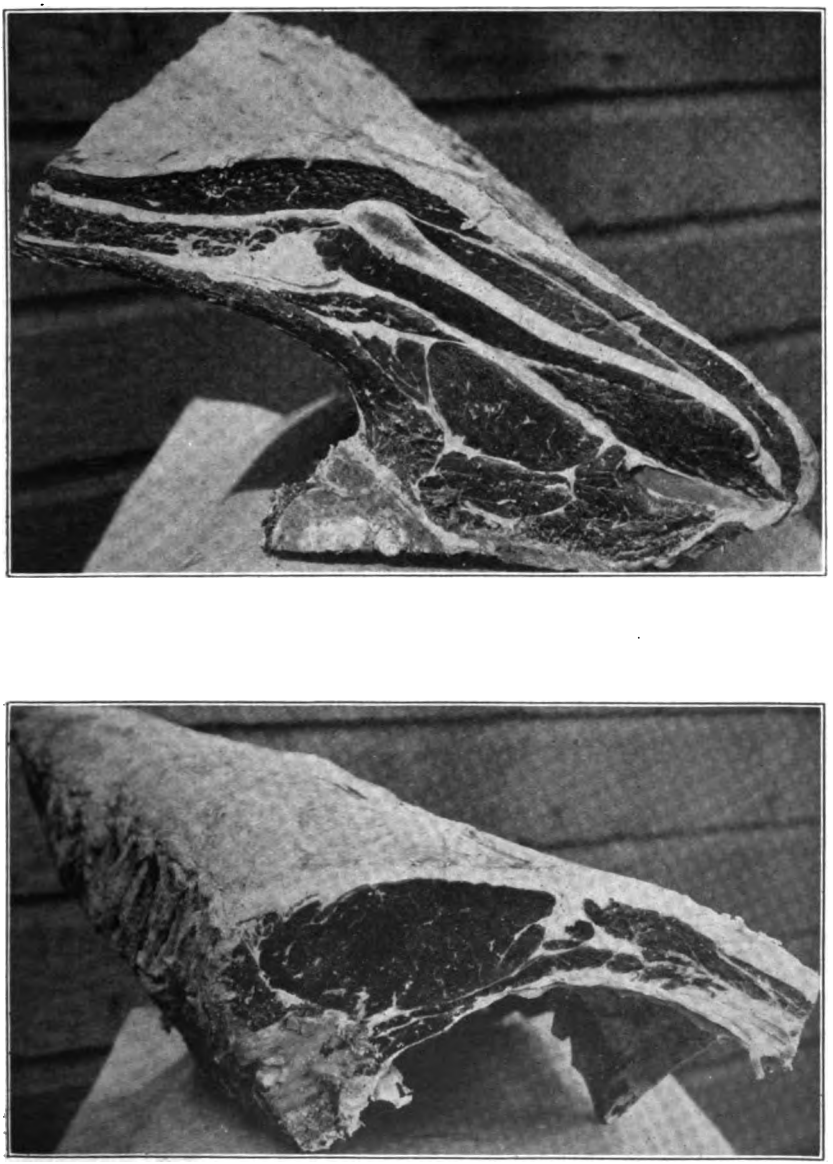

FIG. 14. The Condition of the Rib Cuts Taken from a Steer in Lot 2 at the Close of Experiment.
Ration, Cotton-seed Meal and Corn Silage.

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All cattle feeders in the State have access to the best eastern markets, either through buyers or direct shipments. The results of this experiment show that cattle fed a straight cotton-seed meal and hulls ration will not command a premium like those fed cotton-seed meal and corn silage. Steers which are short-fed from ninety to one hundred and twenty days and marketed locally can be fed satisfactorily on a straight cotton-seed meal and hulls ration. The addition of corn silage even during this short period, however, would give more finish than otherwise. The economy of this practice would depend entirely on the relative market value of cotton-seed hulls and corn silage. If cotton-seed hulls are high in price and corn silage is available, it would likely be economy to use corn silage, at least for part of the roughage ration. If cotton-seed hulls are low in price, it would not be economy to use corn silage unless the cattle were to be long-fed and sold on a discriminating market. Otherwise a straight cotton-seed meal and hulls ration would be more practical. These are factors which depend entirely on the kind of cattle used, the length of the feeding period, the relative cost of the roughage feeds and the place where the cattle are marketed.

FINANCIAL STATEMENTS.

The financial statements given herein are furnished entirely for the benefit of the farmer or practical feeder. This data has no relation whatever to the comparative results recorded formerly in the bulletin. These statements following include all items of expense which would naturally be incurred by the practical cattle feeder. Special attention has been given to these statements to bring out in detail the difference between cotton-seed hulls and corn silage for feeding solely with cotton-seed meal. The market value of corn silage is figured at three prices to suit all conditions in the State.

The advisability of using corn silage exclusively with cotton-seed meal has not been fully established. The writers have in mind some extensive experiments to determine the feasibility of feeding cotton-seed hulls with the cotton-seed meal for ninety to one hundred days, after which corn silage will be substituted wholly or in part for the cotton-seed hulls. This is based on the fact that cotton-seed hulls and corn silage will give about the same results for the period above mentioned. After this, however, the corn silage begins to show a decided value. As far as the results herein reported are concerned, the value of corn silage as a sole roughage feed during the entire feeding period is clear.

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FINANCIAL STATEMENT.

LOT 1—24 STEERS, FED COTTON-SEED MEAL AND COTTON-SEED HULLS.

Cotton-seed Hulls Figured at Standard Price of $7.50 Per Ton.

EXPENDITURES:	
To 24 steers, 22,058.5 pounds, @ $5.75 per cwt.	$ 1,268.36
" freight on above—Clyde to Statesville	33.00
Feed eaten during preliminary period, October 15 to November 2, 1913, inclusive.	
To 1,004 pounds cotton-seed meal @ $27.75 per ton	13.93
" 420 pounds cotton-seed hulls @ $7.50 per ton	1.57
" 6,027 pounds corn silage @ $3.50 per ton	10.55
" 1,458 pounds rye straw @ $5.00 per ton	3.65
Feed eaten during experimental period, November 3, 1913, to February 22, 1914, inclusive.	
To 20,016 pounds cotton-seed meal @ $27.75 per ton	277.72
" 58,995 pounds cotton-seed hulls @ $7.50 per ton	221.23
Feed eaten after close of experiment, February 23 to 25, 1914, inclusive.	
To 112.5 pounds cotton-seed meal @ $27.75 per ton	1.56
" 405 pounds cotton-seed hulls @ $7.50 per ton	1.52
" 1,620 pounds corn silage @ $3.50 per ton	2.84
" 720 pounds crab-grass hay @ $10.00 per ton	3.60
" 25 pounds wheat bran* @ $32.00 per ton	.40
" bedding material	40.00
" 200 hours labor @ 10c. per hour	20.00
Total expenditures	$ 1,899.93
RECEIPTS:	
By 24 steers, 25,540 pounds, @ $7.50 per cwt.	1,915.50
Total profit	15.57
Profit per steer	.64
By 92.63 tons manure @ $2.50 per ton	231.57
Total profit, including manure	247.14
Average profit per steer, including manure	10.29

*Fed through error.

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FINANCIAL STATEMENT.

LOT 2—24 STEERS, FED COTTON-SEED MEAL AND CORN SILAGE.

Corn Silage Valued at Various Prices Per Ton.	Valuation of Corn Silage Per Ton.		
	$3.00.	$3.50.	$4.00.
EXPENDITURES:			
To 24 steers, 22,091.5 pounds, @ $5.75 per cwt.	$1,270.26	$1,270.26	$ 1,270.26
" freight on above—Clyde to Statesville	33.00	33.00	33.00
Feed eaten during preliminary period, October 15 to November 2, 1913, inclusive.			
To 1,004 pounds cotton-seed meal @ $27.75 per ton	13.93	13.93	13.93
" 420 pounds cotton-seed hulls @ $7.50 per ton	1.57	1.57	1.57
" 6,027 pounds corn silage	9.04	10.55	12.05
" 1,458 pounds rye straw @ $5.00 per ton	3.65	3.65	3.65
Feed eaten during experimental period, November 3, 1913, to February 22, 1914, inclusive.			
To 20,016 pounds cotton-seed meal @ $27.75 per ton	277.72	277.72	277.72
" 114,120 pounds corn silage	171.18	199.71	228.24
Feed eaten after close of experiment, February 23 to 25, 1914, inclusive.			
To 112.5 pounds cotton-seed meal @ $27.75 per ton	1.56	1.56	1.56
" 405 pounds cotton-seed hulls @ $7.50 per ton	1.52	1.52	1.52
" 1,620 pounds corn silage	2.43	2.84	3.24
" 720 pounds crab-grass hay @ $10.00 per ton	3.60	3.60	3.60
" 25 pounds wheat bran* @ $32.00 per ton	.40	.40	.40
" bedding material	40.00	40.00	40.00
" 200 hours labor @ 10c. per hour	20.00	20.00	20.00
Total expenditures	$1,849.86	$1,880.31	$ 1,910.74
RECEIPTS:			
By 24 steers, 25,580 pounds, @ $7.70 per cwt.	1,969.66	1,969.66	1,969.66
Total profit	119.80	89.35	58.92
Profit per steer	4.99	3.72	2.45
By 92.63 tons manure @ $2.50 per ton	231.57	231.57	231.57
Total profit, including manure	351.37	320.92	290.49
Average profit per steer, including manure	14.64	13.37	12.10
Average Profit on 48 Steers.			
Total profit	135.37	104.92	74.49
Average profit per steer	2.82	2.19	1.55
Total profit, including manure	598.51	566.06	537.63
Average profit per steer, including manure	12.47	11.84	11.20

*Fed through error.

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THE BULLETIN

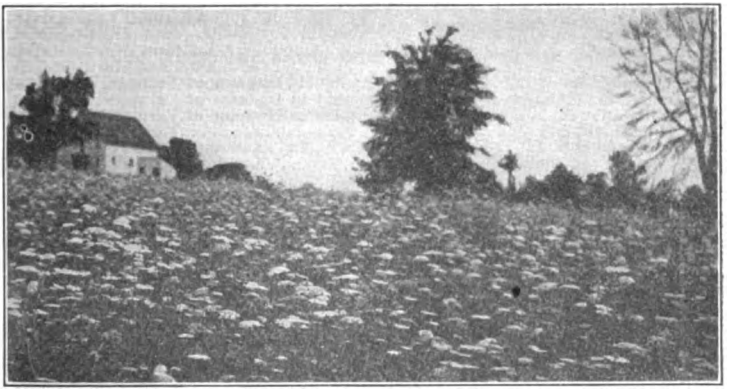
OF THE

NORTH CAROLINA

DEPARTMENT OF AGRICULTURE

RALEIGH

Vol. 35, No. 9. SEPTEMBER, 1914 Whole No. 200



Red Clover Field Overrun by Wild Carrots.

REPORT OF SEED TESTS FOR 1914

PUBLISHED MONTHLY AND SENT FREE TO CITIZENS ON APPLICATION.

Entered at the Postoffice at Raleigh, N. C., as second class matter,

February 7, 1901, under Act of June 6, 1900.

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‡In coöperation with Bureau of Plant Industry, United States Department of Agriculture.

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LETTER OF TRANSMITTAL.

RALEIGH, August 1, 1914.

HON. W. A. GRAHAM,
Commissioner of Agriculture,
Raleigh, N. C.

SIR:—I have the honor to submit herewith the report on the recleaning, analysis, and germination of the agricultural and vegetable seed samples collected and analyzed in accordance with the North Carolina Pure Seed Act; also, samples submitted by interested individuals, from July 15, 1913, to July 15, 1914, and recommend its publication as the September BULLETIN of the Division of Agronomy and Botany of this Department.

Respectfully submitted,

J. L. BURGESS,
Agronomist and Botanist.

Approved for printing:
W. A. GRAHAM,
Commissioner of Agriculture.

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REPORT OF THE DIVISION OF AGRONOMY AND BOTANY FOR 1914

By James L. Burgess, Agronomist and Botanist in Charge.

GENERAL REMARKS.

According to the provisions of the North Carolina Pure Seed Act, seed samples have been collected and analyzed since the act went into effect, July 1, 1909. The present publication is the fourth report of seed tests made by this Department, and includes all samples received from July 15, 1913, to July 15, 1914. During that time 1,773 samples in all have been tested; total agricultural seed samples 955, samples from inspectors 727, samples from individuals 228. Total samples for purity was 872, total samples for germination was 948. Germination tests were made of 818 samples of vegetable seeds. Also 123 samples of tobacco seed were received and cleaned for farmers of the State.

The volume of work in the Seed Laboratory in the handling of agricultural and vegetable seeds, has almost doubled within the past year, as the following tables will show.

TABLE No. 1.

Total Number of Samples of Agricultural Seeds Received.

	1913	1914
Alfalfa	10	28
Barley	3	3
Beans, Soja	1	4
Beans, Velvet	8	1
Grass, Kentucky Blue	19	34
Chufas	2	
Clover, Alsike	2	12
Clover, Burr	1	1
Clover, Crimson	66	131
Clover, Red	51	98
Clover, Sweet	1	3
Field Corn	73	28
Cow Peas	14	1
Meadow Fescue	1	2
Italian Rye Grass	1	7
Orchard Grass	9	51
Tall Meadow Oat Grass	2	14
German Millet	12	14
Pearl Millet	11	6

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TABLE NO. 1—CONTINUED.

	1913	1914
Oats	142	233
Canada Field Peas	2	2
Rape	9	49
Red Top	8	37
Rye	53	64
Timothy	12	33
Winter Vetch	6	41
Wheat	6	26

TABLE No 2.

TOTAL NUMBER OF SAMPLES OF VEGETABLE SEEDS RECEIVED.

Wholesale Dealer	1913	1914
W. W. Barnard Co., Chicago, Ill.	3	9
J. Bolgiano & Son, Baltimore, Md.	3	2
Robert Buist Co., Philadelphia, Pa.	14	63
Crosman Bros. Co., Rochester, N. Y.	27	113
Diggs & Beadles, Richmond, Va.	1	5
D. M. Ferry & Co., Detroit, Mich.	64	233
Lake Shore Seed Co., Dunkirk, N. Y.	30	95
D. Landreth Seed Co., Bristol, Pa.	18	54
Leonard Seed Co., Chicago, Ill.	2	27
L. L. May & Co., St. Paul, Minn.	7	18
J. B. Rice Seed Co., Cambridge, N. Y.	10	73
T. W. Wood & Sons, Richmond, Va.	14	84

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SEED SHOULD BE TESTED AND THE VALUE KNOWN BEFORE PURCHASING.

The wisdom of having seed tested and of knowing the actual cost and value of the seed to be planted may be illustrated by the following data. These samples were tested in the laboratory, and are fairly typical of the different grades of seed offered on the market at the same price.

TABLE No. 3.

Laboratory Number	Kind of Seed	Retail Price	Actual Cost	Actual Value
1388	Crimson Clover	$0.15 per pound	$0.16 per pound	95 per cent.
2232	Crimson Clover	.15 per pound	1.30 per pound	11 per cent.
1427	Red Clover (*No Dodder.*)	.20 per pound	.21 per pound	96 per cent.
1409	Red Clover (*Dodder present.*)	.20 per pound	.30 per pound	48 per cent.
2108	Orchard Grass	.20 per pound	.22 per pound	73 per cent.
2024	Orchard Grass	.20 per pound	.56 per pound	25 per cent.
1534	Redtop	.20 per pound	.22 per pound	87 per cent.
2157	Redtop	.20 per pound	.32 per pound	37 per cent.

WEED SEEDS.

The three kinds of weed seeds of most frequent occurrence in the principal kinds of agricultural seeds tested are given below, the one found most frequently being listed first:

Alfalfa—Buckhorn, Green Foxtail, Lamb's Quarters.

Bluegrass, Kentucky—Field Sorrel, Buckhorn, Large Mouse-ear Chickweed.

Clover, Crimson—Black or Hop Medic, Wild Mustard, Slender Foxtail.

Clover Red—Buckhorn, Curled Dock, Green Foxtail.

Clover, White—Field Sorrel, Black or Hop Medic, Large Mouse-ear Chickweed.

Grass, Orchard—Field Sorrel, Buckhorn, Cheat.

Oats—Cheat, Corn Cockle, Darnel.

Redtop—Yarrow, Rugel's Plaintain, Woolly Panicum.

Out of 51 samples of Red Clover seed tested, Dodder was found to occur in 21 samples, and in no samples of Alfalfa out of 8 samples tested.

According to section 5 of the North Carolina Seed Act, the occurrence of the following weed seeds in agricultural seeds to be used for planting is considered unlawful: Wild Onion or Garlic (*Allium vineale* L. and A. *Canadense* L.), Wild Mustard (*Brassica arvensis* (L.) Ktz.), Couch-grass (*Agropyron repens* (L) Beauv.) Canada Thistle (*Carduus arvensis* (L.) Robs.), Wild Oat (*Avena fatua* L.), Clover Dodder (*Cuscuta Epithymum* Murr), Corn Cockle (*Agrostemma Githago* L.), Cheat (*Bromus secalinus* L.), Dog Fennel (*Eupatorium capillifolium* (Lam.) Small.), Wild Carrot (*Daucus Carota* L.).

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TABLE No. 4.

SHOWING THE FIFTY WEED SEEDS OF MOST COMMON OCCURRENCE, FOUND IN ALL OF THE SAMPLES TESTED FOR PURITY.

(872 Samples Examined.)

	Scientific Name	Common Name	Found in
1	Rumex crispus	Curled Dock	178 samples
2	Rumex acetosella	Field Sorrel	168 samples
3	Medicago lupulina	Black Medic	133 samples
4	Plantago lanceolata	Buckhorn	110 samples
5	Plantago Rugelii	Rugel's Plantain	102 samples
6	Bromus secalinus	Chess	99 samples
7	Chætochloa viridis	Green Foxtail	98 samples
8	Alopecurus agrestis	Slender Foxtail	95 samples
9	Brassica arvensis	Wild Mustard	78 samples
10	Chætochloa glauca	Yellow Foxtail	66 samples
11	Lychnis alba	White Campion	59 samples
12	Potentilla Monspeliensis	Rough Cinquefoil	56 samples
13	Geranium dissectum	Cut-leaved Cranesbill	53 samples
14	Chenopodium album	Lamb's Quarters	49 samples
15	Cerastium vulgatum	Larger Mouse-ear Chickweed	49 samples
16	Carex spp.	Sedges	46 samples
17	Achillea Millefolium	Yarrow	44 samples
18	Sherardia arvensis	Blue Field-madder	42 samples
19	Vicia hirsuta	Hairy Tare	41 samples
20	Holcus lanatus	Velvet Grass	40 samples
21	Agrostemma Githago	Corn Cockle	39 samples
22	Juncus spp.	Rushes	38 samples
23	Galium Aparine	Cleavers	37 samples
24	Lolium temulentum	Darnel	37 samples
25	Polygonum Convolvulus	Black Bindweed	32 samples
26	Ambrosia artemisiaefolia	Ragweed	31 samples
27	Bromus hordeaceus	Soft Chess	31 samples
28	Bromus racemosus	Upright Chess	29 samples
29	Festuca myuros	Rat's-tail Fescue Grass	29 samples
30	Lepidium apetalum	Apetalous Peppergrass	28 samples
31	Polygonum Persicaria	Lady's Thumb	28 samples
32	Lepidium virginicum	Wild Peppergrass	26 samples
33	Koellia flexuosa	Mountain Mint	26 samples
34	Syntherisma sanguinalis	Large Crab-grass	24 samples
35	Silene antirrhina	Sleepy Catch-fly	23 samples
36	Vicia sativa	Spring Vetch	23 samples

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TABLE NO. 4—CONTINUED.

	Scientific Name	Common Name	Found in
37	Carex cephalophora	Oval-headed Sedge	22 samples
38	Panicum capillare	Witch-grass	22 samples
39	Valerianella sp	Corn Salad	21 samples
40	Syntherisma linearis	Small Crab-grass	20 samples
41	Veronica arvensis	Corn Speedwell	20 samples
42	Bursa Bursa-pastoris	Shepherd's Purse	19 samples
43	Daucus carota	Wild Carrot	18 samples
44	Panicularia nervata	Nerved Manna-grass	18 samples
45	Plantago aristata	Large-bracted Plantain	16 samples
46	Conringia orientalis	Hare's-ear Mustard	16 samples
47	Prunella vulgaris	Heal-all	16 samples
48	Allium vineale	Wild Onion	15 samples
49	Lithospermum arvense	Corn Gromwell	15 samples
50	Anthyllis Vulneraria	Kidney Vetch	15 samples

CLEANING TOBACCO SEED.

Two years ago this Division began a new line of work, that of cleaning tobacco seed for farmers of the State. Most gratifying reports have been received from persons for whom seed was cleaned. The following shows the trend of opinion among the tobacco farmers in regard to this new line of work:

"The tobacco seed I had cleaned by the Department of Agriculture last year I gave to one hundred and twenty-five farmers, and find them all pleased with the seed. I want to say that I find a great difference in the results where seeds are cleaned.

"First. I get stronger plants on beds, and have no small, inferior plants.

"Second. The tobacco lives better; not having to replant, grows evenly, not having any late, inferior tobacco to contend with.

"Third. It matures uniformly, making the housing of the crop easier.

"Fourth. I get a better grade of tobacco, heavier and more uniform.

"Fifth. Better plants, regular growth, uniform maturity, heavier crops, and better prices I find to be the result of cleaned seed, with which I am much pleased. I am sending you today my seed for this year to be cleaned."

From a very small beginning this work has grown till during the past year we recleaned and returned to the tobacco farmers enough seed to plant over 43,000 acres of tobacco. The farmers are thus appreciating the importance of clean seed for the tobacco crop as well as for other crops.

The planting of clean seed of high vitality is of such importance that it is hoped the tobacco farmers of the State will take advantage of the opportunity the Department offers and have all of their seed cleaned. This work can be done more efficiently by the Department than by the farmers, as the Seed Laboratory has special apparatus for doing this work. Several times the quantity of seed desired for sowing should be

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sent to insure a sufficient quantity of cleaned seed. The seed should be sent some time before it is wanted. The Department makes no charge for cleaning tobacco seed.

HOW TO SEND SEED SAMPLES FOR TESTING.

Of the smaller seed, such as the grasses and clovers, about three or four tablespoonfuls is a sufficient amount to send for testing. Of the larger seeds, as corn and oats, about a cupful is necessary. The following information should accompany all samples: Name and address of wholesale and retail dealer, retail price, and name and address of sender. Samples should be securely wrapped and addressed to

THE NORTH CAROLINA SEED LABORATORY,
DEPARTMENT OF AGRICULTURE,
RALEIGH, N. C.

TABLE No. 5.

TOBACCO SEEDS RECLEANED FOR THE FARMERS OF THE STATE.

Laboratory Number	Name and Address of Sender	Amount of Recleaned Seed Returned
5136	J. A. Anderson, R. F. D. No. 6, Oxford, N. C.	185 c. c.
5165	A. D. Atkinson, Kenly, N. C.	110 c. c.
5184	W. E. Atkinson, Kenly, N. C.	90 c. c.
5108	J. B. Atwater, Chapel Hill, N. C.	200 c. c.
5199	W. R. Badgett, Pilot Mountain, N. C.	95 c. c.
5118	E. T. Barkley, Elm City, N. C.	365 c. c.
5186	J. D. Barnett, R. F. D. No. 8, Burlington, N. C.	140 c. c.
5183	H. E. Beamer, R. F. D. No. 1, Rush, N. C.	23 c. c.
5151	T. A. Blackwelder, R. F. D. No. 2, Cana, N. C.	160 c. c.
5126	A. W. Blalock, Roxboro, N. C.	130 c. c.
5124	E. R. Blalock, Roxboro, N. C.	520 c. c.
5123	W. R. Blalock, Roxboro, N. C.	460 c. c.
5096	D. C. Blue, White Plains, N. C.	125 c. c.
5092	G. J. Blue, White Plains, N. C.	120 c. c.
5104	E. L. Boswell, Union Ridge, N. C.	950 c. c.
5196	Simeon Bowling, Durham, N. C.	80 c. c.
5164	S. H. Brantley, Spring Hope, N. C.	205 c. c.
5101	C. A. Bray, Greensboro, N. C.	50 c. c.
5160	John L. Bray, Jonesville, N. C.	100 c. c.
5205	W. H. Bray, Jonesville, N. C.	55 c. c.
5170	Z. B. Britt, Garner, N. C.	177 c. c.

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TABLE NO. 5—CONTINUED.

Laboratory Number	Name and Address of Sender	Amount of Recleaned Seed Returned
5125	Frank Brooks, Roxboro, N. C.	260 c. c.
5187	H. T. Brown, R. F. D. No. 2, Sandy Ridge, N. C.	45 c. c.
5204	P. G. Brown, R. F. D. No. 2, Cana, N. C.	20 c. c.
5198	S. Browning, R. F. D. No. 1, West Durham, N. C.	260 c. c.
5192	A. H. Bryant, R. F. D. No. 1, Jonesville, N. C.	95 c. c.
5207	J. O. Burgh, Smith, N. C.	95 c. c.
5194	Elias Carr, Raleigh, N. C.	90 c. c.
5209	Elias Carr, Raleigh, N. C.	105 c. c.
5171	W. J. Cantrell, R. F. D. No. 2, Burlington, N. C.	130 c. c.
5181	J. W. Chandler, Ruffin, N. C.	85 c. c.
5193	C. R. Christian, R. F. D. No. 1, Westfield, N. C.	75 c. c.
5140	S. P. Christian, Westfield, N. C.	580 c. c.
5197	S. P. Christian, Westfield, N. C.	180 c. c.
5175	T. W. Collins, Elkin, N. C.	130 c. c.
5142	W. A. Connell, Warren Plains, N. C.	290 c. c.
5201	Scott H. Cox, R. F. D. No. 2, Pinnacle, N. C.	75 c. c.
5100	Eddie Cozart, Stems, N. C.	600 c. c.
5097	J. H. Craddock, R. F. D. No. 1, Wentworth, N. C.	92 c. c.
5093	J. M. Crews, R. F. D. No. 3, Kernersville, N. C.	100 c. c.
5185	J. M. Davis, R. F. D. No. 2, Boonville, N. C.	62 c. c.
5111	H. C. Denny, R. F. D. No. 3, Pinnacle, N. C.	240 c. c.
5098	A. F. Dickinson, R. F. D. No. 3, Oxford, N. C.	56 c. c.
5119	J. I. Eason, R. F. D. No. 1, Stantonsburg, N. C.	210 c. c.
5200	Lee Essic, Pilot Mountain, N. C.	20 c. c.
5191	C. L. Essick, R. F. D. No. 2, Pinnacle, N. C.	85 c. c.
5190	J. D. Essick, R. F. D. No. 2, Pinnacle, N. C.	65 c. c.
5128	Farmers Exchange, Stoneville, N. C.	180 c. c.
5129	----do	125 c. c.
5088	E. M. Fearington, Riggsbee, N. C.	100 c. c.
5179	Nathan Fields, Princeton, N. C.	185 c. c.
5090	H. A. Finch, R. F. D. No. 1, Kittrell, N. C.	150 c. c.
5169	J. W. Finch, R. F. D. No. 2, Henderson, N. C.	325 c. c.
5103	J. H. Foushee, R. F. D. No. 1, Roxboro, N. C.	840 c. c.
5133	----do	275 c. c.
5087	Andrew J. Garm, R. F. D. No. 2, Sandy Ridge, N. C.	75 c. c.
5182	J. A. Giles, Durham, N. C.	98 c. c.
5235	P. H. Gill, R. F. D. No. 4, Henderson, N. C.	420 c. c.
5156	S. M. Gordon, Pinnacle, N. C.	55 c. c.
5115	Jas. M. Gray, R. F. D. No. 3, Durham, N. C.	165 c. c.

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TABLE No. 5—CONTINUED.

Laboratory Number	Name and Address of Sender	Amount of Recleaned Seed Returned
5172	O. B. Gullie, R. F. D. No. 7, Raleigh, N. C.	90 c. c.
5141	L. D. Hale, R. F. D. No. 1, Danbury, N. C.	98 c. c.
5148	F. M. Halland, R. F. D. No. 2, Kernersville, N. C.	15 c. c.
5149	C. T. Hamm, Tobaccoville, N. C.	135 c. c.
5094	J. W. Hampton, Clemmons, N. C.	100 c. c.
5162	....do	145 c. c.
5113	A. A. Harris, Roxboro, N. C.	475 c. c.
5112	A. J. Harris, Roxboro, N. C.	380 c. c.
5114	G. E. Harris, Roxboro, N. C.	12249 c. c.
5143	M. D. Harris, Durham, N. C.	105 c. c.
5195	C. F. Helsabeck, Rural Hall, N. C.	215 c. c.
5180	H. O. Helsabeck, Rural Hall, N. C.	200 c. c.
5167	J. M. Hester, Below Creek, N. C.	100 c. c.
5173	J. L. Hill, R. F. D. No. 2, Mocksville, N. C.	85 c. c.
5147	Home Savings Bank, Greensboro, N. C.	17693 c. c.
5203	R. A. Hooper, Corbett, N. C.	35 c. c.
5208	D. R. Hopkins, Brown Summit, N. C.	85 c. c.
5127	J. T. Horton, R. F. D. No. 1, Chapel Hill, N. C.	225 c. c.
5139	J. L. Jackson, R. F. D. No. 4, Mt. Airy, N. C.	110 c. c.
5095	J. M. Jackson, R. F. D. No. 1, Stokesdale, N. C.	47 c. c.
5168	J. I. Larimore, R. F. D. No. 3, Winston-Salem, N. C.	45 c. c.
5120	C. L. Lasater, R. F. D. No. 4, Apex, N. C.	230 c. c.
5137	....do	85 c. c.
5146	A. B. Lassiter, Smithfield, N. C.	335 c. c.
5158	H. L. Leonard, R. F. D. No. 3, Lexington, N. C.	80 c. c.
5132	J. C. McCulloch, R. F. D. No. 8, Burlington, N. C.	70 c. c.
5152	H. C. Martin, Stoneville, N. C.	575 c. c.
5102	J. V. Mitchell, Stoneville, N. C.	530 c. c.
5176	E. W. Neel, R. F. D. No. 2, Princeton, N. C.	52 c. c.
5161	J. P. Pace, R. F. D. No. 1, Mebane, N. C.	35 c. c.
5106	Jule. Pace, R. F. D. No. 1, Watson, N. C.	88 c. c.
5159	N. L. Pace, R. F. D. No. 1, Mebane, N. C.	50 c. c.
5121	W. R. Parks, White Plains, N. C.	125 c. c.
5138	E. H. Parrish, Rougemont, N. C.	65 c. c.
5144	....do	68 c. c.
5134	L. P. Pell, Pilot Mountain, N. C.	165 c. c.
5122	M. A. Phelps, Clemmons, N. C.	140 c. c.
5145	A. P. Pickett, R. F. D. No. 1, Durham, N. C.	243 c. c.
5154	Alfred Plummer, Middleburg, N. C.	250 c. c.

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TABLE No. 5—CONTINUED.

Laboratory Number	Name and Address of Sender	Amount of Recleaned Seed Returned
5202	W. P. Ray, R. F. D. No. 1, Smith, N. C.	57 c. c.
5163	J. W. Reece, Mt. Airy, N. C.	100 c. c.
5177	J. E. Roberts, Stoneville, N. C.	165 c. c.
5206	W. L. Rudd, Jericho, N. C.	80 c. c.
5157	C. F. Shield, R. F. D. No. 1, Kernersville, N. C.	75 c. c.
5189	H. D. Shields, R. F. D. No. 1, Kernersville, N. C.	90 c. c.
5130	W. Ed. Shugart, Yadkinville, N. C.	190 c. c.
1566	J. R. Smith, Altamahaw, N. C.	92 c. c.
5131	J. S. Smith, R. F. D. No. 1, White Plains, N. C.	115 c. c.
5105	J. W. Smithwick, Manson, N. C.	445 c. c.
5109	R. W. Snow, Crutchfield, N. C.	170 c. c.
5188	S. J. E. Summers, R. F. D. No. 2, Altamahaw, N. C.	265 c. c.
5091	Pervis Tilley, Bahama, N. C.	38108 c. c.
5155	Wm. Thomas, Hightowers, N. C.	110 c. c.
5174	O. B. Umstead, Stagville, N. C.	210 c. c.
5110	L. R. Wellons, Raleigh, N. C.	205 c. c.
5116	W. T. White, R. F. D. No. 1, Rusk, N. C.	260 c. c.
5153	Wm. M. Whitefield, R. F. D. No. 3, Hurdle Mills, N. C.	135 c. c.
5117	J. C. Whitsell, R. F. D. No. 4, Burlington, N. C.	390 c. c.
5178	E. W. Wilkins, R. F. D. No. 2, Burlington, N. C.	75 c. c.
5150	Jno. H. Wilkins, R. F. D. No. 2, Burlington, N. C.	290 c. c.
5107	J. E. Williams, R. F. D. No. 1, Chapel Hill, N. C.	275 c. c.
5089	J. H. Williams, R. F. D. No. 1, Chapel Hill, N. C.	100 c. c.
5099	J. P. Wilson, R. F. D. No. 2, Madison, N. C.	132 c. c.
	Total	88270 c. c.

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TABLE No. 6.

AGRICULTURAL SEEDS FROM THE FOLLOWING 43 WHOLESALE DEALERS WERE COLLECTED FROM THE NORTH CAROLINA MARKET AND TESTED.

Dealer.	*Location.*
Adams Grain and Provision Co	Asheville, N. C.
Adams Grain and Provision Co	Nashville, Tenn.
Adams Grain and Provision Co	Norfolk, Va.
Adams Grain and Provision Co	Richmond, Va.
Barnard, W. W., & Co	Chicago, Ill.
Beveridge, S. T., & Co	Richmond, Va.
Bolgiano, J., & Son	Baltimore, Md.
Buffington, J. J., & Co	Baltimore, Md.
Buist, Robert, Seed Co	Philadelphia, Pa.
Carter, Venable & Co	Richmond, Va.
Corbett Co., The	Wilmington, N. C.
Diggs & Beadles	Richmond, Va.
Dixon & Etheridge	Goldsboro, N. C.
Gore, D. L., & Co	Wilmington, N. C.
Griffith & Turner Co	Baltimore, Md.
Hackney, Broyles & Lackey Co	Knoxville, Tenn.
Hall & Pearsall	Wilmington, N. C.
Hardin, Hamilton & Lewman	Louisville, Ky.
Harsh Grain Co	Nashville, Tenn.
Hickory Seed Co	Hickory, N. C.
Hines, E. G.	Goldsboro, N. C.
Landreth, D., Seed Co	Bristol, Pa.
Leonard Seed Co	Chicago, Ill.
Lewis & Chambers	Louisville, Ky.
Logan & Co.	Nashville, Tenn.
Louisville Seed Co	Louisville, Ky.
Mayo Milling Co	Richmond, Va.
Meadows, J. A.	New Bern, N. C.
Moose, George	Newton, N. C.
National Seed Co	Louisville, Ky.
Reid, D. P., & Bro	Norfolk, Va.
Rice, J. B., Seed Co	Cambridge, N. Y.
Richardson, W. F., Jr., & Co	Richmond, Va.
Roper & Co	Petersburg, Va.
Savage, N. R., & Son	Richmond, Va.
Scarlett, Wm. G., & Co	Baltimore, Md.
Simpson, W. A., & Co	Baltimore, Md.
Slate Seed Co	South Boston, Va.
Smith Seed & Feed Co	Danville, Va.
Southern Distributing Co	Norfolk, Va.
Tate, W. R.	Nashville, Tenn.
Tennessee Grain Co	Nashville, Tenn.
Wood, T. W., & Sons	Richmond, Va.

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TABLE No. 7.

ADDRESSES AND NAMES OF 288 RETAIL DEALERS IN 106 TOWNS, FROM WHOM AGRICULTURAL SEED SAMPLES WERE COLLECTED AND TESTED.

Location.	*Dealer.*
Ahoskie	S. E. Dilday.
Ahoskie	J. T. Williams & Bro.
Ashboro	McCrary Hardware Co.
Ashboro	J. T. Turner.
Asheville	Grant's Pharmacy.
Asheville	T. S. Morrison & Co.
Asheville	Slayden, Fakes & Co.
Asheville	L. R. Stricker.
Ayden	R. C. Cannon & Sons.
Ayden	H. G. Mumford.
Benson	J. H. Boone & Son.
Benson	W. N. Stewart.
Brevard	W. S. Ashworth & Sons.
Brevard	Brevard Hardware Co.
Bryson City	J. H. Ditmore.
Burgaw	C. Harrell & Son.
Burlington	Coble-Bradshaw Co.
Burlington	Holt & May.
Burlington	Jos. A. Iseley, Bros. & Co.
Cameron	Farmers Union Supply Co.
Cameron	M. McL. McKeithen.
Canton	J. C. Cole.
Canton	G. L. Hampton.
Chadbourn	Chadbourn Grocery Co.
Chadbourn	Lonlenon & Lonlenon.
Charlotte	Bridgers & Co.
Charlotte	Davidson & Wolfe.
Charlotte	Farmers Supply Co.
Charlotte	W. J. Fite.
Charlotte	Johnston Bros.
Clinton	Aman Grocery Co.
Clinton	J. G. Hobbs.
Clinton	J. C. Peterson.
Clinton	B. F. Powell.
Concord	H. M. Blackwelder.
Concord	Cline & Moose.
Concord	W. J. Glass.
Concord	H. L. Parks & Co.
Concord	White, Morrison, Flowe Co.
Dunn	Hood & Grantham.
Dunn	Johnson Bros.
Dunn	James E. Jordan.
Dunn	J. L. Thompson.
Durham	Byrd & Upchurch.
Durham	Carlton-Hackney Drug Co.
Durham	Carpenter Bros.
Durham	Five Points Drug Co.
Durham	Haywood & Boone.
Durham	C. E. King & Sons.
Durham	J. T. Rogers & Co.
Edenton	H. C. Prevatt.
Elizabeth City	T. P. Nash.
Elizabeth City	Spence & Hollowell Co.
Elizabeth City	W. S. White & Co.
Elm City	E. O. McGowan.
Elm City	R. S. Wells.
Enfield	Bellamy & Co.

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Dealer.	*Location.*
Enfield	Curtis-Parson Co.
Enfield	Curtis, Pierce & Co.
Enfield	Lawrence Bros.
Enfield	B. D. Mann.
Fairmont	A. J. Floyd.
Farmville	R. L. Davis & Bros.
Farmville	T. L. & W. J. Turnage Co.
Fayetteville	A. S. Huske.
Fayetteville	A. E. Rankin & Co.
Forest City	Florence Mills.
Franklinton	Franklin Grocery Co.
Franklinton	McGhee-Joyner Co.
Franklinton	Whedbee & Morris.
Franklinton	C. S. Williams.
Fremont	Geo. D. Best & Son.
Fremont	Hooks, Bellame & Co.
Fremont	Z. M. L. Peacock.
Fremont	Yelverton & Bros.
Gastonia	Gaston Seed & Provision Co.
Gastonia	M. T. Parham & Co.
Goldsboro	M. J. Best & Sons.
Goldsboro	H. L. Bizzell.
Goldsboro	Geo. E. Daniels.
Goldsboro	Deans & Moye Co.
Goldsboro	Z. M. L. Jeffreys.
Goldsboro	Thompson & Sons.
Goldsboro	T. N. Waters & Bro.
Goldsboro	Williams Drug Store.
Goldsboro	W. V. Williams.
Greensboro	Carolina Warehouse.
Greensboro	J. F. Fulton.
Greensboro	R. G. Hiatt & Co.
Greensboro	C. Scott & Co.
Greenville	J. B. Johnston.
Greenville	J. R. & J. G. Moyes.
Greenville	L. M. Savage.
Gulf	W. S. Russell.
Halifax	N. L. Stedman & Co.
Henderson	Beacom Supply Co.
Henderson	E. G. Davis & Son Co.
Henderson	Parham Supply Co.
Henderson	W. W. Parker.
Henderson	Geo. A. Rose & Co.
Henderson	Thomas Bros.
Henderson	White-Hight Co.
Hendersonville	Byers Bros.
Hendersonville	Farmers Hardware & Supply Co.
Hendersonville	J. O. Houston & Sons.
Hendersonville	F. V. Hunter.
Hendersonville	Hunter's Pharmacy.
Hickory	Boyd Feed Co.
Hickory	City Feed Co.
Hickory	Hickory Seed Co.
High Point	Beeson Hardware Co.
High Point	High Point Hardware Co.
Hillsboro	Geo. A. Durham.
Hillsboro	H. L. Parrish.
Hillsboro	H. W. & J. C. Webb.
Kenly	G. G. Edgerton & Son.
Kenly	J. T. Egerton.
Kings Mountain	Kiser & Mauney.
Kings Mountain	W. A. Mauney & Bro.

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Dealer.	*Location.*
Kings Mountain	Patterson Grocery Co.
Kinston	Ray Dawson.
Kinston	Henry Dunn.
Kinston	J. E. Hood & Co.
Kinston	T. W. Mewborn & Co.
Kinston	Temple Drug Co.
LaGrange	Isbel & Peele.
LaGrange	E. S. Mewborn.
LaGrange	T. W. Pace.
Laurinburg	John F. McNair.
Lenoir	Harrison & Co.
Lexington	Robert L. Leonard.
Lexington	Lexington Hardware Co.
Lexington	S. L. Owen & Co.
Lincolnton	Lowing & Costner.
Lincolnton	J. H. Rudisill & Co.
Littleton	Eugene Johnson.
Littleton	Littleton Feed & Grocery Co.
Littleton	Littleton Grocery Co.
Littleton	J. H. Newsom.
Littleton	S. J. Stallings.
Louisburg	Allen Bros. Co.
Louisburg	L. P. Hicks.
Louisburg	McKinne Bros.
Lucama	Lucas & Bass Co.
Lucama	W. J. Newsom & Bro.
Lumberton	L. H. Caldwell.
Lumberton	M. W. Floyd.
Magnolia	George Edwards.
Magnolia	Roy Hill Co.
Magnolia	J. C. Horne.
Magnolia	Theo. Middleton.
Marion	J. D. Blanton.
Marion	Gaston & Tate.
Marshall	W. J. Gudger & Son.
Marshall	T. N. James & Co.
Marshall	Madison County Farmers Union.
Marshall	A. L. Plemmons.
Marshall	Tweed & Franklin.
Maxton	J. W. Carter.
Maysville	A. C. Foster.
Mocksville	J. T. Angell.
Mocksville	Walker's Bargain House.
Monroe	F. B. Ashcraft.
Mooresville	Harris & McNeely.
Mooresville	W. M. Neel & Co.
Morganton	W. A. Leslie.
Morganton	Shuping & Poteat.
Mount Airy	W. E. Merritt & Co.
Mount Airy	Mount Airy Feed Store.
Mount Airy	F. L. Smith Hardware Co.
Mount Gilead	Bruton & Co.
Mount Gilead	Farmers Supply Co.
Mount Gilead	Thomas H. Graham.
Mount Gilead	Frank McAuley.
Mount Gilead	J. A. McAuley.
Mount Gilead	Mount Gilead Store Co.
Mount Olive	Y. H. Knowles.
Mount Olive	J. M. Lewis.
Mount Olive	E. G. Martin, Son & Co.
Mount Olive	Mount Olive Grocery & Hardware Co.
Murphy	R. H. Hyatt & Co.

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Dealer.	*Location.*
Nashville	Arrington-Bissett Co.
Nashville	Cockerell & Williams Co.
Nashville	King Coöperative Co.
Nashville	Nash Supply Co.
Nashville	Planters Supply Co.
Nashville	J. D. Winstead & Son.
New Bern	J. F. Clarke.
New Bern	C. B. Hill.
New Bern	C. L. Spencer.
Newton	George Moose.
Norwood	Hart Drug Co.
Oxford	Breedlove & McFarland.
Oxford	J. D. Brooks.
Oxford	J. W. & D. S. Fuller.
Oxford	Horner Bros.
Oxford	Lyon-Winston Co.
Oxford	R. S. Montague.
Oxford	Winston-Long Co.
Parmele	J. C. Bryan & Co.
Parmele	Gray & Roebuck.
Plymouth	A. L. Owens.
Raeford	N. S. Blue & Co.
Reidsville	J. H. Burton.
Reidsville	Harris & Hubbard.
Reidsville	Hazell & Mims.
Reidsville	W. P. Ware.
Robersonville	Roberson-Holiday Co.
Robersonville	J. H. Roberson & Co.
Robersonville	W. A. Roberson & Co.
Rockingham	McRae Grocery Co.
Rocky Mount	Dozier & Griffin.
Rocky Mount	George S. Edwards.
Rocky Mount	H. C. Joyner.
Rocky Mount	T. L. Warsley.
Rocky Mount	W. T. Williford.
Roxboro	Garrett & Stanfield Co.
Roxboro	C. H. Hunter.
Roxboro	Sergeant & Clayton.
Roxboro	Hugh Woods.
Rural Hall	E. L. Kiser & Co.
Rutherfordton	Thompson & Watkins.
Rutherfordton	Williams & Erwin.
Salisbury	W. L. Klutz.
Salisbury	M. C. Rufty.
Salisbury	Union Warehouse.
Sanford	Lee, Stone & Co.
Sanford	Wilkins, Ricks & Co.
Scotland Neck	Edwards & Co.
Scotland Neck	W. T. Hancock & Co.
Scotland Neck	M. Hoffman & Bro.
Selma	C. E. Kornegay.
Selma	Selma Supply Co.
Shelby	R. E. Campbell.
Shelby	J. N. Dellinger.
Shelby	H. E. Kendall.
Shelby	W. B. Palmer's Sons.
Shelby	Paul Webb.
Siler City	The Hardware Store.
Smithfield	Austin-Stephenson Co.
Smithfield	Carter-Underwood Co.

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Dealer.	*Location.*
Smithfield	W. M. Sanders.
Spring Hope	N. B. Finch & Co.
Spring Hope	W. H. Griffin & Co.
Spring Hope	T. C. May & Son.
Statesville	Miller-McLean Supply Co.
Statesville	J. E. Sloop.
Sylva	B. H. Cathey & Co.
Sylva	Sylva Cash Store.
Sylva	Sylva Supply Co.
Tarboro	W. S. Clarke & Sons.
Tarboro	R. E. L. Cook.
Tarboro	R. B. Peters Grocery Co.
Taylorsville	J. B. Barnes.
Thomasville	Crutchfield Hardware Co.
Thomasville	Thomasville Drug Co.
Troy	G. W. Allen & Sons.
Troy	A. W. E. Capel.
Troy	Saunders & Co.
Wadesboro	Parsons Drug Co.
Wallace	Duplin Grocery Co.
Wallace	Hall Mercantile Co.
Wallace	Wallace Grocery Co.
Warrenton	Burroughs Grocery Co.
Warsaw	J. B. Cox.
Warsaw	Hobbs & Russ.
Washington	Walter Credle & Co.
Washington	Hardy Drug Co.
Waxhaw	Wolfe Drug Co.
Waynesville	Chautauqua Drug Co.
Weldon	L. J. Mooré.
Weldon	W. T. Parker.
Whitakers	Whitaker's Pharmacy.
Wilkesboro	Miller Grocery Co.
Wilkesboro	N. B. Smyhey.
Wilkesboro, North	C. Call.
Williamston	Anderson-Crawford Co.
Williamston	Harrison Bros. & Co.
Wilson	Hadley-Harriss Co.
Wilson	Doane Herring.
Wilson	Wilson Drug Co.
Wilson	Wilson Grocery Co.
Windsor	J. P. Freeman.
Winston-Salem	J. J. Adams' Sons Co.
Winston-Salem	T. M. Benton.
Winston-Salem	Farmers Cash and Feed Store.
Winston-Salem	Farmers Union Agency Co.
Winston-Salem	B. A. Poindexter.

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TABLE No. 8.

VEGETABLE SEEDS FROM THE FOLLOWING 16 WHOLESALE DEALERS WERE COLLECTED FROM THE NORTH CAROLINA MARKET AND TESTED.

Dealer.	*Location.*
Barnard, W. W., & Co	Chicago, Ill.
Bolgiano, J., & Son	Baltimore, Md.
Buist, Robert, Co	Philadelphia, Pa.
Burpee, W. Atlee, & Co	Philadelphia, Pa.
Clarke, Everett B., Seed Co	Milford, Conn.
Crosman Bros. Co	Rochester, N. Y.
Diggs & Beadles	Richmond, Va.
Ferry, D. M., & Co	Detroit, Mich.
Griffith & Turner	Baltimore, Md.
Lake Shore Seed Co	Dunkirk, N. Y.
Landreth, D., Seed Co	Bristol, Pa.
Leonard Seed Co	Chicago, Ill.
May, L. L., & Co	St. Paul, Minn.
Rice, J. B., Seed Co	Cambridge, N. Y.
Wood, Stubbs & Co	Louisville, Ky.
Wood, T. W., & Sons	Richmond, Va.

TABLE No. 9.

ADDRESSES AND NAMES OF 218 RETAIL DEALERS IN 97 TOWNS FROM WHOM VEGETABLE SEED SAMPLES WERE COLLECTED AND TESTED.

Location.	*Dealer.*
Aberdeen	Standard Store Co.
Ahoskie	S. J. Dilday.
Albemarle	E. C. Kirk.
Albemarle	Morrow Bros. & Heath Co.
Albemarle	Shankle-Snuggs Co.
Asheville	Grant's Pharmacy.
Beaufort	Beaufort Drug Co.
Beaufort	Potter Bros.
Beaufort	M. R. Springle.
Belhaven	W. H. Bowen & Son.
Benson	W. F. Smith.
Boardman	Buthers Lumber Co.
Brevard	Brevard Hardware Co.
Burgaw	C. Harrell & Son.
Burgaw	Singestory Drug Co.
Canton	W. G. Cole.
Chadbourn	Brown Mercantile Co.
Charlotte	Charlotte Drug Co.
Charlotte	W. L. Hond & Co.
Charlotte	Reese & Alexander, Inc.
Charlotte	Woodall & Sheppard.
Clinton	D. M. Patrick & Co.
Clinton	J. C. Peterson.
Clinton	B. F. Powell.
Clinton	H. S. Southerland.
Cofield	Hill Bros.
Concord	Cabarrus Drug Co.
Concord	Cook & Harris.
Concord	Davis Drug Co.
Concord	Dove-Bost Co.
Concord	Gibson Drug Co.
Davidson	Armour Bros. & Thompson.
Dover	W. A. Wilson.

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Location.	*Dealer.*
Dunn	N. A. Bell & Co.
Dunn	Hood & Grantham.
Dunn	Robinson Bros.
Edenton	W. R. Brothers.
Edenton	W. A. Leggett.
Edenton	J. A. Mitchener.
Edenton	Mitchener's Pharmacy.
Edenton	W. S. White.
Elizabeth City	Spence & Hollowell.
Elizabeth City	W. S. White & Co.
Elm City	J. L. Bailey.
Elm City	J. W. Sharp.
Enfield	Harrison & Hill Drug Co.
Farmville	T. L. & W. J. Turnage Co.
Fayetteville	A. J. Cook & Co.
Fayetteville	J. B. Fields.
Fayetteville	A. S. Huske.
Franklinton	Franklin Grocery Co.
Franklinton	T. L. Joyner.
Gastonia	Adams Drug Co.
Gastonia	Gaston Seed & Provision Co.
Gastonia	Kennedy's Drug Co.
Gastonia	Torrence Drug Co.
Goldsboro	M. J. Best & Son.
Goldsboro	George E. Daniels.
Goldsboro	Deans & Moye Co.
Goldsboro	Z. M. L. Jeffreys.
Goldsboro	B. G. Thompson & Son.
Goldsboro	T. N. Waters & Bro.
Greensboro	J. F. Fulton.
Greensboro	C. Scott & Co.
Greenville	J. B. Johnston.
Greenville	J. L. Stashey.
Greenville	John L. Wooten Drug Co.
Halifax	Furgerson Drug Co.
Hamlet	Hamlet Pharmacy.
Hamlet	Earle Morrow Drug Store.
Hamlet	E. L. Rhodes.
Henderson	W. W. Parker.
Henderson	Thomas Bros.
Hendersonville	Bradsher's Pharmacy.
Hendersonville	T. B. Carson.
Hertford	W. S. Blanchard & Son.
Hertford	Divers & Roper.
Hertford	Watson & Winslow.
High Point	S. F. Brown & Co.
High Point	Mann Drug Co.
Jackson	E. S. Barrett & Co.
Jackson	Taylor & Cowan.
Jacksonville	G. T. Walton & Co.
Kings Mountain	Barnes-Finger Drug Co.
Kings Mountain	Kiser & Mauney.
Kinston	Henry Dunn.
Kinston	J. E. Hood & Co.
Kinston	Lenoir Drug Co.
Kinston	E. B. Marston Drug Co.
Kinston	Temple Drug Co.
LaGrange	F. Barwick.
LaGrange	E. S. Mewborn.
LaGrange	E. E. Rouse & Co.
Laurinburg	J. T. Fields.
Laurinburg	R. G. Stone.

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Location.	*Dealer.*
Lincolnton	W. C. Asbury.
Lincolnton	Lawnings Drug Store.
Lincolnton	Lowing & Costner.
Lincolnton	J. H. Rudisill & Co.
Littleton	Herbert Smith.
Louisburg	Aycock Drug Co.
Louisburg	Beasley-Austin Drug Co.
Louisburg	F. R. Pleasants.
Madison	Madison Grocery Co.
Magnolia	J. C. Horne.
Magnolia	F. D. Scott & Co.
Marion	Davis Pharmacy.
Maxton	E. L. Burns.
Maxton	A. L. Jones.
Monroe	English Drug Co.
Monroe	Latham & Richardson.
Monroe	C. N. Simpson, Jr.
Monroe	Dr. S. J. Welsh & Son.
Morehead City	J. B. Morton.
Morganton	L. A. Kincaid.
Morganton	Leslie Drug Store.
Mount Airy	W. F. Midkiff.
Mount Airy	Mount Airy Feed Store.
Mount Airy	The Peoples Drug Store.
Mount Airy	I. W. West Drug Co.
Mount Gilead	Bruton & Co.
Mount Olive	M. R. Jennett.
Mount Olive	Y. H. Knowles.
Mount Olive	J. M. Lewis.
Mount Olive	Martin & Price Co.
Mount Olive	Mount Olive Grocery and Hardware Co.
Mount Olive	M. W. Pope.
Nashville	Nash Supply Co.
Nashville	J. D. Winstead & Son.
New Bern	J. F. Clarke.
New Bern	B. B. Davenport.
New Bern	F. S. Duffy.
New Bern	C. L. Spencer.
New Bern	S. W. Willis.
Newton	Clarence Clapp.
Norwood	Hart Drug Co.
Oriental	W. J. Morgan.
Oxford	Hamilton Drug Co.
Oxford	J. T. Sizemore.
Oxford	L. Thomas.
Plymouth	Alexander & Blount.
Plymouth	Tom L. Smith.
Plymouth	Henry L. Spruill.
Polloksville	H. A. Chadwick.
Proctorville	Barnes Bros.
Raeford	Raeford Hardware Co.
Red Springs	Red Springs Drug Co.
Red Springs	John J. Steward Co.
Red Springs	John J. Thrower Co.
Reidsville	W. S. Allen.
Reidsville	Fetzer & Tucker.
Reidsville	Harris & Hubbard.
Roanoke Rapids	Wells Dilery.
Robersonville	Roberson, Cory & Co.
Robersonville	J. H. Roberson & Co.
Rockingham	E. N. Covington & Co.
Rockingham	Eagle Pharmacy.

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Location.	*Dealer.*
Rockingham	L. G. Fox.
Rockingham	E. D. Whitelock.
Rocky Mount	Fitzgerald Drug Co.
Rocky Mount	H. C. Joyner.
Rocky Mount	Kyser's Drug Store.
Rocky Mount	C. R. L. Matthews
Rocky Mount	May & Gorman.
Roseboro	D. W. Tart.
Salisbury	J. W. McPherson & Co.
Salisbury	M. C. Rufty.
Scotland Neck	G. T. Whitehead & Co.
Selma	Selma Drug Co.
Selma	Selma Supply Co.
Shelby	H. E. Kendall.
Smithfield	W. M. Sanders.
Star	Mitchell & Barrow.
Tarboro	R. E. L. Cook.
Tarboro	Robinson-Ruffin Co.
Tarboro	Tarboro Grocery Co.
Vanceboro	H. L. Arnold.
Wadesboro	Fox & Lyon.
Wadesboro	Parson Drug Co.
Wadesboro	V. F. Tarlton.
Wallace	Murray & Armstrong.
Walnut Cove	Golden Rule Drug Store.
Warrenton	Burroughs Grocery Co.
Warrenton	Hunter Drug Co.
Warsaw	W. D. Thomas & Co.
Washington	Blount Pharmacy.
Washington	W. A. & J. G. Blount.
Washington	A. J. Cox & Co.
Washington	Walter Credle & Co.
Washington	Hardy Drug Co.
Washington	E. K. Willis.
Washington	Worthy & Etheridge.
Waxhaw	Harris Bros.
Waynesville	Chautauqua Drug Co.
Waynesville	Miller Bros.
Weldon	E. Clarke.
Wilkesboro	Miller Grocery Co.
Williamston	Theo. Roberson & Co.
Williamston	Saunders & Fowden.
Wilmington	R. R. Bellamy.
Wilmington	J. H. Hardin.
Wilmington	W. J. Kirkman & Co.
Wilson	Doane Herring.
Wilson	Ruffin-High Co.
Wilson	J. D. Williams.
Wilson	Wilson Drug Co.
Windsor	J. J. Madre & Bro.
Winston-Salem	J. J. Adams' Sons Co.
Winston-Salem	J. Emra Cox.
Winston-Salem	Eford Bros.
Winston-Salem	Farmers Trade House Co.
Winston-Salem	J. G. Messick.
Winston-Salem	E. W. O'Hanlon & Co.
Winston-Salem	Owens Drug Co.
Winston-Salem	P. A. Thompson.
Winton	W. P. Shaw, Jr., & Bro.
Youngsville	E. T. Alford.
Youngsville	Winston-Blanks Drug Co.

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TABLE No. 10.

VEGETABLE SEED SAMPLES WERE COLLECTED IN THE FOLLOWING 60 COUNTIES.

Anson.
Beaufort
Bertie.
Buncombe.
Burke.
Cabarrus.
Carteret.
Catawba.
Chowan.
Cleveland.
Columbus.
Craven.
Cumberland.
Duplin.
Edgecombe.
Forsyth.
Franklin.
Gaston.
Granville
Guilford.
Halifax.
Harnett.
Haywood.
Henderson.
Hertford.
Johnston.
Jones.
Lenoir.
Lincoln.
McDowell.
Martin.
Mecklenburg.
Montgomery.
Moore.
Nash.
New Hanover.
Northampton.
Onslow.
Pamlico.
Pasquotank.
Pender.
Perquimans.
Pitt.
Richmond.
Robeson.
Rockingham.
Rowan.
Sampson.
Scotland.
Stanly.
Stokes.
Surry.
Transylvania.
Union.
Vance.
Warren.
Washington.
Wayne.
Wilkes.
Wilson.

TABLE No. 11.

AGRICULTURAL SEED SAMPLES WERE COLLECTED IN THE FOLLOWING 70 COUNTIES.

Alamance.
Alexander.
Anson.
Beaufort.
Buncombe.
Burke.
Cabarrus.
Caldwell.
Catawba.
Chatham.
Cherokee.
Chowan.
Cleveland.
Columbus.
Craven.
Cumberland.
Davidson.
Davie.
Duplin.
Durham.
Edgecombe.
Forsyth.
Franklin.
Gaston.
Granville.
Guilford.
Halifax.
Harnett.
Haywood.
Henderson.
Hertford.
Iredell.
Jackson.
Johnston.
Jones.
Lee.
Lenoir.
Lincoln.
McDowell.
Madison.
Martin.
Mecklenburg.
Montgomery.
Moore.
Nash.
Orange.
Pasquotank.
Pender.
Person.
Pitt.
Randolph.
Richmond.
Robeson.
Rockingham.
Rowan.
Rutherford.
Sampson.
Scotland.
Stanly.
Surry.
Swain.
Transylvania.
Union.
Vance.
Warren.
Washington.
Wayne.
Wilkes.
Wilson.

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TABLE XII.—RESULTS OF TESTS OF 28 KINDS OF AGRICULTURAL SEEDS, 727 SAMPLES IN ALL, COLLECTED BY INSPECTORS FROM JULY 15, 1913 TO JULY 15, 1914.

Laboratory Number	Kind of Seed and Name of Unlawful Seed Present	Wholesale Dealer	Retail Dealer	Per Cent of Pure Seed	Per Cent of Inert Matter	Per Cent of Foreign Seed	Per Cent of Germination
6079	ALFALFA	J. Bolgiano & Son, Baltimore, Md.	Hickory Seed Co., Hickory, N. C.	99.22	.25	.53	86.5
6082	....do	Diggs & Beadles, Richmond, Va.	Farmers Cash and Feed Store, Winston-Salem, N. C.	99.48	.16	.36	91.0
2971	....do	....do	C. E. King & Sons, Durham, N. C.	*94.15	.33	5.52	†41.0
6078	....do	Hardin, Hamilton & Lewman, Louisv., Ky.	Gaston & Tate, Marion, N. C.	99.36	.28	.36	91.5
6398	....do	N. R. Savage & Son, Richmond, Va.	George Moose, Newton, N. C.	99.41	.28	.31	91.0
6155	....do	T. W. Wood & Sons, Richmond, Va.	A. W. E. Capel, Troy, N. C.	99.59	.37	.04	86.0
6206	....do	....do	Cline & Moose, Concord, N. C.	98.38	.57	1.05	80.0
6081	....do	....do	Farmers Union Agency Co., Winston-Salem, N. C.	98.92	.35	.73	†78.0
6279	....do	....do	J. F. Fulton, Greensboro, N. C.	99.70	.28	.02	88.0
6239	....do	....do	A. S. Huske, Fayetteville, N. C.	99.63	.23	.14	95.0
6399	....do	....do	H. E. Kendall, Shelby, N. C.	99.54	.27	.19	93.0
6080	....do	....do	W. A. Leslie, Morganton, N. C.	99.60	.35	.05	88.5
6157	....do	....do	W. S. Russell, Gulf, N. C.	98.94	.41	.65	†77.0
6156	....do	....do	Saunders & Company, Troy, N. C.	96.89	2.72	.39	†59.5
6107	Barley (*Cheat.*)	S. T. Beveridge & Co., Richmond, Va.	C. Scott & Co., Greensboro, N. C.	97.96	1.42	.62	99.5
6108	....do	Wm. G. Scarlett & Co., Baltimore, Md.	Farmers Union Agency Winston-Salem, N. C.	99.37	.63	.00	99.5
2909	....do (*Cheat.*)	T. W. Wood & Sons, Richmond, Va.	E. O. McGowan, Elm City, N. C.	98.30	1.22	.48	98.0
6541	BLUEGRASS, KENTUCKY	S. T. Beveridge & Co., Richmond, Va.	J. H. Ditmore, Bryson City, N. C.	*65.19	34.24	.57	61.0

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6501	....do	Robert Buist Co., Philadelphia, Pa.	Boyd Feed Co., Hickory, N. C.	83.40	16.23	.37	57.0
6089	....do	Carter, Venable & Co., Richmond, Va.	Harrison & Company, Lenoir, N. C.	81.67	18.14	.19	†35.5
2969	....do	Diggs & Beadles, Richmond, Va.	C. E. King & Sons, Durham, N. C.	*78.23	21.10	.67	56.0
6161	....do	Hardin, Hamilton & Lewman, Louisv., Ky.	Davidson & Wolfe, Charlotte, N. C.	85.17	14.74	.09	55.0
6092	....do	....do	Gaston & Tate, Marion, N. C.	*74.77	25.14	.09	52.5
6091	....do	....do	C. Scott & Co., Greensboro, N. C.	80.27	19.44	.29	61.5
6542	....do	Lewis & Chambers, Louisville, Ky.	G. L. Hampton, Canton, N. C.	81.43	17.43	1.14	†26.0
6389	....do	N. R. Savage & Son, Richmond, Va.	Gaston Seed & Provision Co.,Gastonia,N.C.	85.69	14.02	.29	52.0
6275	....do	....do	Hasel & Mimes, Reidsville, N. C.	86.42	12.81	.77	†41.0
6276	....do	....do	W. E. Merritt & Co., Mount Airy, N. C.	90.04	9.58	.38	56.0
6390	....do	....do	George Moose, Newton, N. C.	88.97	10.35	.68	50.0
6499	....do	Wm. G. Scarlett & Co., Baltimore, Md.	Shuping & Poteat, Morganton, N. C.	84.37	15.14	.49	†43.0
6203	....do	T. W. Wood & Sons, Richmond, Va.	Cline & Moose, Concord, N. C.	80.65	17.52	1.83	62.5
6237	....do	....do	....do	79.61	20.03	.36	44.5
6238	....do	....do	Farmers Supply Co., Charlotte, N. C.	*73.34	15.64	11.02	54.0
6202	....do	....do	Gaston Seed & Prov. Co., Gastonia, N. C.	81.10	16.89	2.01	60.5
6391	....do	....do	H. E. Kendall, Shelby, N. C.	82.25	1.46	1.15	†38.5
6090	....do	....do	S. L. Owen & Co., Lexington, N. C.	*79.30	18.81	1.89	64.0
6160	....do	....do	Wilkins, Ricks & Co., Sanford, N. C.	80.63	17.32	2.05	65.5
6500	....do	....do	Slayden, Fakes & Co., Asheville, N. C.	*69.39	30.14	.47	52.5
2996	CANE	....do	A. S. Huske, Fayetteville, N. C.	98.74	.93	.33	†62.5
2997	....do	....do	....do	98.76	1.07	.17	†20.0
6093	CLOVER, ALSIKE	S. T. Beveridge & Co., Richmond, Va.	Harrison & Co., Lenoir, N. C.	89.20	1.83	8.97	†67.3
6127	....do	N. R. Savage & Son, Richmond, Va.	Farmers Supply Co., Charlotte, N. C.	96.30	.24	3.46	77.3
6280	....do	....do	J. F. Fulton, Greensboro, N. C.	95.65	.25	4.10	82.3
6126	....do	T. W. Wood & Sons, Richmond, Va.	A. W. E. Capel, Troy, N. C.	98.98	.63	.39	†56.8

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Laboratory Number	Kind of Seed and Name of Unlawful Seed Present	Wholesale Dealer	Retail Dealer	Per Cent of Pure Seed	Per Cent of Inert Matter	Per Cent of Foreign Seed	Per Cent of Germination
6400	CLOVER, ALSIKE	T. W. Wood & Sons, Richmond, Va.	Gaston Seed & Prov. Co., Gastonia, N. C.	99.55	.25	.20	†71.0
6094	---do	---do	W. A. Leslie, Morganton, N. C.	97.20	2.27	.53	†62.3
6104	CLOVER, BUR	Diggs & Beadles, Richmond, Va.	Farmers Cash & Feed Store, Winston-Salem, N. C.	94.74	3.96	1.30	32.5
2973	CLOVER, CRIMSON	S. T. Beveridge & Co., Richmond, Va.	Anderson, Crawford Co., Williamston, N. C.	*96.42	2.52	1.06	99.0
6116	---do	---do	Farmers Supply Co., Charlotte, N. C.	*96.66	1.45	1.89	95.5
6118	---do (*Wild mustard.*)	---do	Farmers Union Supply Co., Cameron, N. C.	97.97	1.62	.41	93.0
6115	---do	---do	W. J. Fite, Charlotte, N. C.	*96.88	1.28	1.84	94.5
2880	---do	---do	Franklin Grocery Co., Franklinton, N. C.	*97.36	2.11	.53	94.5
2879	---do (*Wild mustard.*)	---do	Z. M. L. Jeffreys, Goldsboro, N. C.	*97.04	1.61	1.35	†69.5
6117	---do (*Wild mustard.*)	---do	Johnston Brothers, Charlotte, N. C.	97.54	1.71	.73	88.0
2914	---do	---do	H. L. Parrish, Hillsboro, N. C.	99.33	.49	.18	91.0
6017	---do (*Wild mustard.*)	---do	Paul Webb, Shelby, N. C.	97.97	1.66	.37	95.5
2893	---do	J. Bolgiano & Son, Baltimore, Md.	Dosier & Griffin, Rocky Mount, N. C.	*96.31	2.65	1.04	†73.0
6111	---do	---do	Hart Drug Co., Norwood, N. C.	98.53	1.08	.39	88.5
2912	---do (*Wild mustard.*)	---do	Holt & May, Burlington, N. C.	97.99	.74	1.27	91.5
2913	---do	---do	H. W. and J. C. Webb, Hillsboro, N. C.	*97.40	2.58	.02	†82.0
6114	---do	John J. Buffington & Co., Baltimore, Md.	Davidson & Wolfe, Charlotte, N. C.	97.73	1.54	.73	91.5
6233	---do	---do	---do	98.06	1.27	.67	91.0
2932	---do (*Wild mustard.*)	Carter, Venable & Co., Richmond, Va.	Coble-Bradshaw Co., Burlington, N. C.	*96.92	1.48	1.60	93.0
2933	---do	---do	---do	*97.06	2.58	.36	95.5

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2878	do (*Wild mustard, Wild Onion.*)	do	Deans & Moye Co., Goldsboro, N. C.	*97.30	2.22	.48	†77.5
2928	do	do	Geo. A. Durham, Hillsboro, N. C.	97.74	1.97	.29	93.0
2929	do	do	do	*96.92	2.60	.48	†81.5
6016	do	do	Harrison & Co., Lenoir, N. C.	*97.03	2.34	.63	97.0
6110	do	do	M. McL. McKeithen, Cameron, N. C.	*97.45	1.56	.99	96.5
2891	do (*Wild mustard, Corn cockle.*)	do	Parham Supply Co., Henderson, N. C.	*96.68	2.68	.64	†82.5
2930	do	do	Winston-Long Co., Oxford, N. C.	*94.82	4.19	.99	91.0
2931	do (*Wild mustard.*)	do	do	98.40	1.37	.23	91.5
2892	do	Diggs & Beadles, Richmond, Va.	The Beacom Supply Co., Henderson, N. C.	*96.27	2.42	1.31	94.5
6019	do	do	T. M. Benton, Winston-Salem, N. C.	99.61	12.00	.27	†83.0
6297	do	do	do	97.60	1.99	.41	92.5
6170	do	do	Cline & Moose, Concord, N. C.	*97.22	1.41	1.37	91.5
6171	do	do	do	*95.94	2.42	1.64	91.0
2974	do	do	A. S. Huske, Fayetteville, N. C.	*97.04	1.25	1.71	96.0
2975	do	do	A. S. Huske, Fayetteville, N. C.	*96.57	2.58	.85	96.0
6018	do (*Wild mustard.*)	do	Robt. L. Leonard, Lexington, N. C.	*97.32	2.27	.41	96.0
2915	do	do	Geo. A. Rose, Henderson, N. C.	98.02	1.27	.71	98.0
2877	do	Roper & Co., Petersburg, Va.	Allen Bros. Co., Louisburg, N. C.	99.73	-------	.27	†54.5
2926	do (*Wild mustard.*)	do	Breedlove & McFarland, Oxford, N. C.	*96.87	2.22	.91	91.5
2927	do	do	do	98.10	1.82	.08	90.0
2925	do	do	L. P. Hicks, Louisburg, N. C.	*97.28	2.01	.71	95.0
2882	do	do	E. Johnson, Littleton, N. C.	96.08	1.15	.77	97.0
2923	do (*Wild mustard.*)	do	McGhee-Joyner Co., Franklinton, N. C.	*96.91	2.21	.88	88.5
2883	do	do	S. J. Stallings, Littleton, N. C.	97.81	1.32	.87	95.5
2922	do (*Wild mustard.*)	do	Whedbee & Morris, Franklinton, N. C.	98.18	1.18	.64	86.5
2924	do (*Wild mustard.*)	do	White-Hight Co., Henderson, N. C.	*95.98	3.71	.31	†73.5

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TABLE XII.—RESULTS OF TESTS OF 28 KINDS OF AGRICULTURAL SEEDS, 727 SAMPLES IN ALL, COLLECTED BY INSPECTORS FROM JULY 15, 1913 TO JULY 15, 1914—CONTINUED.

Laboratory Number	Kind of Seed and Name of Unlawful Seed Present	Wholesale Dealer	Retail Dealer	Per Cent of Pure Seed	Per Cent of Inert Matter	Per Cent of Foreign Seed	Per Cent of Germination
2881	CLOVER, CRIMSON (*Wild mustard.*)	Roper & Co., Petersburg, Va.	C. S. Williams, Franklinton, N. C.	98.08	1.56	.36	93.0
2918	do	N. R. Savage & Son, Richmond, Va.	J. D. Brooks, Oxford, N. C.	*96.87	2.48	.65	85.0
6504	do (*Wild mustard.*)	do	City Feed Co., Hickory, N. C.	98.29	.71	1.00	95.5
2921	do (*Wild mustard.*)	do	Holt & May, Burlington, N. C.	*97.42	1.84	.74	90.0
2919	do (*Wild mustard.*)	do	Horner Bros., Oxford, N. C.	98.48	1.15	.37	87.0
6113	do (*Wild mustard.*)	do	Johnston Bros., Charlotte, N. C.	*97.45	1.76	.79	93.0
6011	do (*Wild mustard.*)	do	Lexington Hardware Co., Lexington, N. C.	*96.69	2.87	.46	98.5
2876	do (*Wild mustard.*)	do	McKinne Bros. Co., Louisburg, N. C.	98.40	1.42	.18	86.0
6013	do (*Wild mustard.*)	do	W. E. Merritt & Co., Mount Airy, N. C.	98.81	.96	.23	90.5
6012	do (*Wild mustard.*)	do	Mount Airy Feed Store, Mount Airy, N. C.	*95.13	4.47	.36	97.0
6112	do (*Wild mustard.*)	do	W. M. Sanders, Smithfield, N. C.	*97.34	2.35	.31	86.5
2920	do (*Wild mustard.*)	do	Hugh Woods, Roxboro, N. C.	*96.91	2.55	.54	84.5
2916	do	Slate Seed Co., South Boston, Va.	Sergeant & Clayton, Roxboro, N. C.	98.08	1.69	.23	88.5
2917	do	do	Hugh Woods, Roxboro, N. C.	*96.97	1.89	1.14	88.0
6015	do	Smith Seed & Feed Co., Danville, Va.	J. H. Burton, Reidsville, N. C.	98.79	.76	.45	98.5
6014	do	do	Harris & Hubbard, Reidsville, N. C.	*96.24	3.47	.29	98.5
6120	do	T. W. Wood & Sons, Richmond, Va.	G. W. Allen & Son, Troy, N. C.	98.69	.94	.37	95.0
6000	do (*Wild mustard.*)	do	Beeson Hardware Co., High Point, N. C.	*96.46	1.77	1.77	96.0
6001	do (*Wild mustard.*)	do	do	*96.92	2.64	.44	97.0

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2938	do (*Wild mustard.*)	do	Byrd & Upchurch, Durham, N. C.	*96.93	2.18	.91	96.0
6003	do	do	R. E. Campbell, Shelby, N. C.	97.63	1.58	.79	96.0
6121	do	do	A. W. E. Capel, Troy, N. C.	97.71	.71	1.58	96.5
2937	do	do	Carlton-Hackney Drug Co., Durham, N. C.	97.57	2.06	.37	95.5
2939	do (*Wild mustard.*)	do	Carpenter Bros., Durham, N. C.	98.23	1.46	.31	97.5
6002	do (*Wild mustard.*)	do	Crutchfield Hardware Co., Thomasville, N. C.	98.05	1.42	.53	92.0
2886	do (*Wild mustard.*)	do	Curtis, Parson Co., Enfield, N. C.	*96.74	2.40	.86	86.5
6008	do	do	Farmers Cash & Feed Store, Winston-Salem, N. C.	97.62	1.49	.89	97.0
6123	do (*Wild mustard.*)	do	Farmers Supply Co., Mount Gilead, N. C.	98.47	1.05	.48	97.5
2935	do (*Wild mustard.*)	do	Five Points Drug Co., Durham, N. C.	*97.17	2.55	.28	84.5
2941	do	do	J. W. & D. S. Fuller, Oxford, N. C.	*96.17	3.06	.77	86.5
6124	do	do	Thomas H. Graham, Mount Gilead, N. C.	98.90	.64	.46	93.0
2976	do	do	Hardy Drug Co., Washington, N. C.	98.06	1.01	.93	93.5
6397	do	do	Harris & McNeely, Morrisville, N. C.	*95.21	3.84	.95	84.5
2936	do	do	Haywood & Boone, Durham, N. C.	98.26	1.37	.37	90.5
6005	do	do	Hasel & Mims, Reidsville, N. C.	*96.70	2.93	.37	98.0
6006	do (*Wild mustard.*)	do	R. G. Hiatt & Co., Greensboro, N. C.	*97.09	2.17	.76	92.5
2999	do (*Wild mustard.*)	do	High Point Hardware Co., High Point, N. C.	*96.19	2.84	.97	†80.5
2934	do	do	Jos. A. Iseley, Bros. & Co., Burlington, N. C.	97.94	1.85	.21	93.5
6543	do (*Wild mustard.*)	do	J. N. James & Co., Marshall, N. C.	*97.00	2.01	.99	89.5
6004	do	do	H. E. Kendall, Shelby, N. C.	99.28	.66	.06	96.0
6166	do	do	Kiser & Mauney, Kings Mountain, N. C.	98.22	1.17	.61	94.5
6010	do (*Wild mustard.*)	do	Lexington Hardware Co., Lexington, N. C.	98.36	.91	.73	93.0
2884	do (*Wild mustard.*)	do	Littleton Grocery Co., Littleton, N. C.	*96.07	2.95	.98	†69.0

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Laboratory Number	Kind of Seed and Name of Unlawful Seed Present	Wholesale Dealer	Retail Dealer	Per Cent of Pure Seed	Per Cent of Inert Matter	Per Cent of Foreign Seed	Per Cent of Germination
2977	CLOVER, CRIMSON	T. W. Wood & Sons, Richmond, Va.	Lucas & Bass Co., Lucama, N. C.	98.01	1.70	.29	92.0
2888	do (*Wild mustard.*)	do	E. O. McGowan, Elm City, N. C.	99.10	.76	.14	93.0
2887	do (*Wild mustard.*)	do	B. D. Mann, Enfield, N. C.	*95.62	2.49	1.89	93.0
6167	do	do	W. A. Mauney & Bro., Kings Mountain, N. C.	*97.30	1.86	.84	98.5
6396	do	do	Miller-McLean Supply Co., Statesville, N.C.	97.94	1.57	.49	93.0
6210	do (*Wild mustard.*)	do	W. M. Neel & Co., Mooresville, N. C.	*95.51	2.41	2.08	91.5
2942	do	do	J. H. Newsom, Littleton, N. C.	*96.82	2.71	.47	†74.5
6009	do	do	S. L. Owen & Co., Lexington, N. C.	*97.46	1.68	.86	93.5
6164	do	do	M. T. Parham, Gastonia, N. C.	*96.53	.71	2.76	99.5
6165	do (*Wild mustard.*)	do	do	97.75	1.62	.63	93.0
2890	do	do	Parham Supply Co., Henderson, N. C.	*96.88	2.87	.25	†83.0
2885	do	do	W. T. Parker, Weldon, N. C.	*95.45	3.35	1.20	97.0
2940	do (*Wild mustard.*)	do	W. W. Parker, Henderson, N. C.	*96.66	.59	.75	93.5
6168	do	do	Patterson Grocery Co., Kings Mtn., N. C.	*97.18	1.76	1.06	94.5
6119	do	do	W. S. Russell, Gulf, N. C.	*97.18	.73	2.09	91.0
6123	do	do	Saunders & Co., Troy, N. C.	98.89	.78	.33	93.0
6007	do	do	F. L. Smith Hardware Co., Mount Airy, N. C.	*96.67	2.22	1.11	93.0
6211	do (*Wild mustard.*)	do	N. B. Smyhey, Wilkesboro, N. C.	97.70	1.51	.79	91.0
2889	do (*Wild mustard.*)	do	Thomas Bros., Henderson, N. C.	*97.26	2.31	.43	†78.0

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6169	....do	....do	White-Morrison-Flowe Co., Concord, N. C.	98.81	.94	.25	88.5
6125	....do	....do	Wilkins, Ricks Co., Sanford, N. C.	*96.11	3.33	.56	89.5
6020	....do (*Wild mustard.*)	Imported seed	Hickory Seed Co., Hickory, N. C.	*95.55	1.55	2.90	93.0
6573	CLOVER, JAPAN	T. W. Wood & Sons, Richmond, Va.	A. S. Huske, Fayetteville, N. C.	90.87	1.74	7.39	48.0
6288	CLOVER, RED	S. T. Beveridge & Co., Richmond, Va.	J. J. Adams & Sons Co., Winston-Salem, N. C.	99.60	.20	.20	85.0
2992	....do	....do	Anderson Crawford & Co., Williamston, N. C.	99.50	.48	.02	91.5
6467	....do	....do	Boyd Feed Co., Hickory, N. C.	97.84	1.36	.80	87.5
6525	....do	....do	J. H. Ditmore, Bryson City, N. C.	99.37	.30	.33	91.5
6128	....do	....do	Farmers Supply Co., Charlotte, N. C.	99.67	.21	.12	83.5
6370	....do	....do	Lowing & Costner, Lincolnton, N. C.	97.66	1.23	1.11	89.5
6129	....do	....do	Mt. Gilead Store Co., Mt. Gilead, N. C.	98.94	.45	.61	91.5
6524	....do (*Dodder.*)	J. Bolgiano & Son, Baltimore, Md.	Chautauqua Drug Co., Waynesville, N. C.	98.38	.82	.80	94.
2960	....do (*Wild carrot.*)	....do	H. W. & J. C. Webb, Hillsboro, N. C.	93.03	.64	.33	†40.5
6465	....do (*Wild carrot.*)	J. J. Buffington & Co., Baltimore, Md.	J. D. Blanton, Marion, N. C.	97.87	.90	1.23	96.0
6466	....do (*Wild carrot.*)	....do	....do	97.70	1.63	.67	95.5
6351	....do	....do	T. P. Nash, Elizabeth City, N. C.	97.93	1.56	.51	†77.5
2963	....do (*Dodder.*)	Carter, Venable & Co., Richmond, Va.	C. H. Hunter, Roxboro, N. C.	94.73	1.13	4.14	79.5
6291	....do (*Dodder.*)	Diggs & Beadles, Richmond, Va.	T. M. Benton, Winston-Salem, N. C.	96.22	1.29	2.49	79.5
2991	....do	....do	A. S. Huske, Fayetteville, N. C.	99.01	.76	.23	80.5
2959	....do (*Wild carrot.*)	....do	C. E. King & Sons, Durham, N. C.	93.63	6.07	.30	80.5
6038	....do (*Dodder.*)	....do	Thomasville Drug Co., Thomasville, N. C.	93.27	.71	1.02	82.5
6526	....do	Hackney, Broyles & Lackey Co., Knoxville, Tenn.	R. H. Hiatt, Murphy, N. C.	97.96	.47	1.57	97.0
6036	....do (*Wild mustard.*)	Hardin, Hamilton & Lewman, Louisv., Ky.	City Feed Co., Hickory, N. C.	94.38	2.11	3.51	83.0
6520	....do	....do	W. J. Gudger & Son, Marshall, N. C.	94.23	1.65	4.12	90.5
6521	....do	....do	G. L. Hampton, Canton, N. C.	96.30	2.14	1.56	88.0

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TABLE XII.—RESULTS OF TESTS OF 28 KINDS OF AGRICULTURAL SEDSE, 727 SAMPLES IN ALL, COLLECTED BY INSPECTORS FROM JULY 15, 1913 TO JULY 15, 1914—CONTINUED.

Laboratory Number	Kind of Seed and Name of Unlawful Seed Present	Wholesale Dealer	Retail Dealer	Per Cent of Pure Seed	Per Cent of Inert Matter	Per Cent of Foreign Seed	Per Cent of Germination
6208	CLOVER, RED	Hardin, Hamilton& Lewman, Louisville,Ky.	W. M. Neel & Co., Mooresville, N. C.	99.80	.12	.08	†75.0
6209	....do	....do	....do	99.63	.37		84.5
6522	....do	Lewis & Chambers, Louisville, Ky.	G. L. Hampton, Canton, N. C.	99.47	.31	.22	94.0
6523	....do	....do	....do	98.82	.37	.81	92.0
6518	....do	Louisville Seed Co., Louisville, Ky.	B. H. Cathey & Co., Sylva, N. C.	96.96	1.16	1.88	88.5
6519	....do	....do	....do	93.22	.44	1.34	92.5
6037	....do	....do	Hickory Seed Co., Hickory, N. C.	89.97	4.52	5.51	84.0
6043	....do (*Wild mustard.*)	N. R. Savage & Son, Richmond, Va.	C. Call, N. Wilkesboro, N. C.	98.34	1.27	.39	88.5
6044	....do	....do	....do	98.70	.63	.67	83.0
6292	....do	....do	....do	99.00	.43	.57	97.0
6234	....do	....do	Davidson & Wolfe, Charlotte, N. C.	99.02	.54	.44	93.5
6040	....do	....do	Harris & Hubbard, Reidsville, N. C.	99.51	.22	.27	88.5
6041	....do	....do	Hasel & Mims, Reidsville, N. C.	99.35	.33	.32	92.5
6042	....do	....do	....do	99.26	.39	.35	89.5
6262	....do	....do	....do	99.68	.14	.18	92.0
6039	....do	....do	Lexington Hardware Co., Lexington, N. C.	99.74	.06	.20	83.5
6373	....do	....do	Miller Grocery Co., Wilkesboro, N. C.	99.02	.55	.43	97.0
6371	....do	....do	George Moose, Newton, N. C.	99.65	.16	.19	92.5
6372	....do	....do	....do	99.12	.44	.41	96.5
6263	....do (*Wild carrot.*)	....do	Mt. Airy Feed Store, Mt. Airy, N. C.	98.90	.63	.47	92.5

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6264	do	do	do	98.87	.73	.40	95.0
6235	do	do	H. L. Parks & Co., Concord, N. C.	99.17	.65	.18	93.5
6269	do	W. G. Scarlett & Co., Baltimore, Md.	E. L. Kiser & Co., Rural Hall, N. C.	98.87	.92	.21	96.0
6375	do	do	W. M. Neel & Co., Mooresville, N. C.	98.74	.99	.27	97.0
6374	do (*Wild carrot.*)	do	J. H. Rudisill & Co., Lincolnton, N. C.	99.42	.23	.35	89.0
6468	do	do	Shuping & Poteat, Morganton, N. C.	98.25	1.50	.25	96.5
6236	do	T. W. Wood & Sons, Richmond, Va.	F. B. Ashcraft, Monroe, N. C.	98.84	.66	.50	90.0
6366	do	do	J. B. Barnes, Fayetteville, N. C.	99.67	.17	.16	95.0
6268	do	do	Bruton & Co., Mt. Gilead, N. C.	99.70	.24	.06	84.5
2961	do	do	Carlton-Hackney Drug Co., Durham. N. C.	99.00	.53	.47	97.5
6289	do	do	Farmers Union Agency Co., Winston-Salem, N. C.	99.44	.21	.35	84.5
6265	do	do	J. F. Fulton, Greensboro, N. C.	99.32	.16	.52	86.5
2962	do	do	Garrett & Stanfield Co., Roxboro, N. C.	99.41	.40	.19	91.0
6197	do	do	Gaston Seed & Prov. Co., Gastonia, N. C.	99.49	.33	.18	83.5
6201	do	do	do	98.46	.31	1.25	87.5
6367	do	do	do	99.00	.53	.47	87.5
6034	do	do	R. G. Hiatt & Co., Greensboro, N. C.	91.94	3.50	4.56	†71.0
6463	do (*Wild carrot, Dodder.*)	do	F. V. Hunter, Hendersonville, N. C.	98.26	.41	1.33	85.5
6200	do	do	Kiser & Mauney, Kings Mountain, N. C.	98.17	1.17	.66	94.5
6198	do	do	W. L. Klutz, Salisbury, N. C.	99.55	.37	.08	†72.0
6032	do	do	W. A. Leslie, Morganton, N. C.	98.46	.73	.81	†77.0
6368	do	do	Lowing & Costner, Lincolnton, N. C.	99.72	.12	.16	93.5
6369	do	do	do	99.67	.12	.21	97.0
6130	do	do	Frank McAuley, Mt. Gilead, N. C.	98.96	.52	.52	89.0

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TABLE XII.—RESULTS OF TESTS OF 28 KINDS OF AGRICULTURAL SEEDS, 727 SAMPLES IN ALL, COLLECTED BY INSPECTORS FROM JULY 15, 1913 TO JULY 15, 1914—CONTINUED.

Laboratory Number	Kind of Seed and Name of Unlawful Seed Present	Wholesale Dealer	Retail Dealer	Per Cent of Pure Seed	Per Cent of Inert Matter	Per Cent of Foreign Seed	Per Cent of Germination
6267	CLOVER, RED	T. W. Wood & Sons, Richmond, Va.	McCrary Hardware Co., Asheboro, N. C.	99.70	.22	.03	89.5
6364	do (*Canada Thistle.*)	do	Miller-McLean Supply Co., Statesville, N. C.	97.72	.65	1.63	89.5
6033	do	do	S. L. Owen & Co., Lexington, N. C.	99.36	.29	.35	98.0
6290	do	do	B. A. Poindexter, Winston-Salem, N. C.	99.52	.27	.21	96.0
6199	do	do	M. C. Rufty, Salisbury, N. C.	99.16	.41	.43	87.0
6517	do	do	Sylva Supply Co., Sylva, N. C.	99.88	.12	.10	96.5
6464	do	do	Thompson & Watkins, Rutherfordton, N. C.	99.39	.30	.31	95.5
6266	do	do	J. T. Turner, Asheboro, N. C.	99.49	.45	.06	96.0
6035	do	do	W. P. Ware, Reidsville, N. C.	99.34	.53	.13	87.5
6031	do	do	Paul Webb, Shelby, N. C.	99.43	.45	.12	96.5
6365	do	do	do	99.43	.20	.37	85.5
6572	do (*Wild carrot, Dodder.*)	do	W. S. White & Co., Elizabeth City, N. C.	94.30	2.97	2.73	90.5
6470	do	do	Grant's Pharmacy, Asheville, N. C.	99.05	.65	.30	94.5
6471	do		Grant's Pharmacy, Asheville, N. C.	97.98	1.72	.30	95.0
6469	do (*Wild carrot.*)		T. S. Morrison & Co., Asheville, N. C.	98.57	.86	.57	90.0
6472	do		Slayden, Fakes & Co., Asheville, N. C.	98.83	.53	.64	85.0
6473	do		L. R. Stricker, Asheville, N. C.	96.33	1.04	2.63	89.0
6502	CLOVER, SWEET	do	Boyd Feed Co., Hickory, N. C.	95.79	3.90	.31	44.5
6490	CLOVER, WHITE	do	Farmers Hardware & Supply Co., Hendersonville, N. C.	99.09	.09	.82	89.3

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6095	....do....	....do....	W. A. Leslie, Morganton, N. C.	99.19	.33	.48	79.5
6254	....do....	....do....	W. S. White & Co., Elizabeth City, N. C.	98.08	.34	1.58	86.0
6571	....do....	....do....	....do....	98.38	.23	1.39	83.0
6339	CORN, FIELD.	Barnard Seed Co., Chicago, Ill.	T. N. Waters & Bro., Goldsboro, N. C.				†92.0
6462	....do....	Robert Buist Co., Philadelphia, Pa.	R. E. L. Cook, Tarboro, N. C.				96.0
6563	....do....	....do....	Hood & Grantham, Dunn, N. C.				94.0
6377	....do....	....do....	Lowing & Costner, Lincolnton, N. C.				94.0
6566	....do....	Griffith & Turner Co., Baltimore, Md.	A. S. Huske, Fayetteville, N. C.				98.0
6493	....do....	D. Landreth Seed Co., Bristol, Pa.	Brevard Hardware Co., Brevard, N. C.				94.0
6376	....do....	....do....	J. H. Rudisill & Co., Lincolnton, N. C.				†90.0
6460	....do....	J. B. Rice Seed Co., Cambridge, N. Y.	W. W. Parker, Henderson, N. C.				†84.0
6461	....do....	....do....	....do....				94.0
6337	....do....	N. R. Savage & Son, Richmond, Va.	Y. H. Knowles, Mt. Olive, N. C.				†90.0
6338	....do....	....do....	....do....				100.0
6378	....do....	....do....	J. E. Sloop, Statesville, N. C.				97.0
6379	....do....	....do....	....do....				95.0
6564	....do....	Slate Seed Co., South Boston, Va.	A. S. Huske, Fayetteville, N. C.				93.0
6565	....do....	....do....	....do....				96.0
6491	....do....	T. W. Wood & Sons, Richmond, Va.	Brevard Hardware Co., Brevard, N. C.				93.0
6492	....do....	....do....	....do....				†91.0
6334	....do....	....do....	J. C. Horne, Magnolia, N. C.				96.0
6380	....do....	....do....	H. E. Kendall, Shelby, N. C.				96.0
6381	....do....	....do....	....do....				95.0
6335	....do....	....do....	B. F. Powell, Clinton, N. C.				98.0
6336	....do....	....do....	....do....				94.0

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TABLE XII.—RESULTS OF TESTS OF 28 KINDS OF AGRICULTURAL SEEDS, 727 SAMPLES IN ALL, COLLECTED BY INSPECTORS FROM JULY 15, 1913 TO JULY 15, 1914—CONTINUED.

Laboratory Number	Kind of Seed and Name of Unlawful Seed Present	Wholesale Dealer	Retail Dealer	Per Cent of Pure Seed	Per Cent of Inert Matter	Per Cent of Foreign Seed	Per Cent of Germination
6103	FESCUE, MEADOW	T. W. Wood & Sons, Richmond, Va.	Farmers Union Agency Co., Winston-Salem, N. C.	98.77	1.07	.16	84.5
6401	do	do	Gaston Seed & Prov. Co., Gastonia, N. C.	97.99	1.47	.54	†46.0
6162	RYEGRASS, ITALIAN	do	Davidson & Wolfe, Charlotte, N. C.	97.84	.62	1.54	†45.5
6101	do	do	Farmers Union Agency Co., Winston-Salem, N. C.	98.51	.97	.52	†53.0
6100	do	do	W. A. Leslie, Morganton, N. C.	93.59	.64	.77	†15.0
6507	do		L. R. Stricker, Asheville, N. C.	97.19	2.05	.76	†30.5
6532	GRASS, ORCHARD	S. T. Beveridge & Co., Richmond, Va.	J. H. Ditmore, Bryson City, N. C.	72.35	25.81	1.84	69.5
6153	do	do	Farmers Supply Co., Charlotte, N. C.	84.75	14.69	.56	85
6270	do	J. Bolgiano & Son, Baltimore, Md.	Beeson Hardware Co., High Point, N. C.	88.27	9.86	1.87	86.5
2966	do (*Wild onion.*)	do	H. W. & J. C. Webb, Hillsboro, N. C.	76.98	17.88	5.14	84.0
6482	do (*Wild onion.*)	J. J. Buffington & Co., Baltimore, Md.	J. D. Blanton, Marion, N. C.	77.91	21.10	.99	38.5
6527	do	Hackney, Broyles & Lackey Co., Knoxville, Tenn.	R. H. Hyatt, Murphy, N. C.	*37.66	51.50	10.84	†66.5
6528	do	do	Tweed & Franklin, Marshall, N. C.	*35.65	59.79	4.56	79.5
2859	do	Hardin, Hamilton & Lewman, Louisv., Ky.	Davidson & Wolfe, Charlotte, N. C.	73.16	26.10	.74	89.5
6152	do	do	do	86.19	13.42	.39	89.5
6232	do	do	do	97.27	2.34	.39	86.0
2794	do	do	J. O. Houston & Son, Hendersonville, N. C.	*68.76	30.22	1.02	87.5
2795	do (*Cheat.*)	do	Hunter Pharmacy, Hendersonville, N. C.	*55.40	43.20	1.40	81.0

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6531	---do	Lewis & Chambers, Louisville, Ky.	G. L. Hampton, Canton, N. C.	82.61	17.17	.22	95.0
6530	---do	Louisville Seed Co., Louisville, Ky.	B. H. Cathey & Co., Sylva, N. C.	*51.08	48.14	.78	84.0
2797	---do	---do	Grant's Pharmacy, Asheville, N. C.	*59.30	39.86	.84	83.5
	(*Cheat.*)						
2796	---do	---do	R. H. Hyatt & Co., Murphy, N. C.	79.16	19.66	1.18	84.0
2798	---do	National Seed Co., Louisville, Ky.	Slayden, Fakes & Co., Asheville, N. C.	85.25	14.66	.09	82.0
6295	---do	N. R. Savage & Son, Richmond, Va.	Farmers Cash Feed Store, Winston-Salem, N. C.	81.71	14.84	3.45	70.5
6088	---do	---do	Hazell & Mims, Reidsville, N. C.	80.39	17.07	2.54	88.0
6271	---do	---do	---do	85.25	7.86	6.89	86.5
6294	---do	---do	Miller Grocery Co., Wilkesboro, N. C.	78.20	16.24	5.56	69.5
6272	---do	---do	Mt. Airy Feed Store, Mt. Airy, N. C.	73.92	23.63	2.45	71.5
2965	---do	---do	Hugh Woods, Roxboro, N. C.	69.86	20.01	10.13	78.0
	(*Wild onion.*)						
6385	---do	Wm. G. Scarlett & Co., Baltimore, Md.	W. M. Neel & Co., Mooresville, N. C.	90.04	9.24	.72	96.0
6481	---do	---do	Shuping & Poteat, Morganton, N. C.	85.39	13.83	.78	90.0
6083	---do	T. W. Wood & Sons, Richmond, Va.	Beeson Hardware Co., High Point, N. C.	84.74	14.01	1.25	91.5
6193	---do	---do	Cline & Moose, Concord, N. C.	88.46	8.58	2.96	85.5
	(*Quack grass.*)						
6084	---do	---do	Crutchfield Hardware Co., Thomasville, N. C.	*68.15	28.63	3.22	74.0
6383	---do	---do	Gaston Seed & Prov. Co., Gastonia, N. C.	83.90	9.62	6.48	90.5
6154	---do	---do	The Hardware Store, Siler City, N. C.	70.99	25.57	3.44	†67.0
2964	---do	---do	Haywood & Boone, Durham, N. C.	79.32	20.58	.10	92.0
6086	---do	---do	H. E. Kendall, Shelby, N. C.	89.30	7.63	3.04	86.5
6382	---do	---do	---do	80.65	17.79	1.56	83.0
6194	---do	---do	W. L. Kluts, Salisbury, N. C.	90.59	7.02	2.39	89.0
6085	---do	---do	W. A. Leslie, Morganton, N. C.	69.83	29.64	.53	78.5
6384	---do	---do	Lowing & Costner, Lincolnton, N. C.	88.16	9.13	2.71	86.5
6212	---do	---do	Miller-McLean Supply Co., Statesville, N.C.	85.90	13.23	.87	93.5

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TABLE XII—RESULTS OF TESTS OF 28 KINDS OF AGRICULTURAL SEEDS, 727 SAMPLES IN ALL, COLLECTED BY INSPECTORS FROM JULY 15, 1913 TO JULY 15, 1914—CONTINUED.

Laboratory Number	Kind of Seed and Name of Unlawful Seed Present	Wholesale Dealer	Retail Dealer	Per Cent of Pure Seed	Per Cent of Inert Matter	Per Cent of Foreign Seed	Per Cent of Germination
6529	GRASS, ORCHARD (*Cheat.*)	T. W. Wood & Sons, Richmond, Va.	Sylva Supply Co., Sylva, N. C.	76.98	21.56	1.46	81.0
6087	do (*Wild carrot.*)	do	Thomasville Hardware Co., Thomasville, N. C.	69.85	27.57	2.58	79.0
2872	do	do	Wolfe Drug Co., Waxhaw, N. C.	71.46	26.94	1.60	†69.0
2774	do (*Wild onion.*)		Farmers Union Agency Co., Winston-Salem, N. C.	*59.02	34.77	6.21	82.5
6484	do		T. S. Morrison & Co., Asheville, N. C.	83.86	9.97	6.17	77.0
6485	do		Slayden, Fakes & Co., Asheville, N. C.	76.85	17.65	5.50	74.5
6483	do		L. R. Stricker, Asheville, N. C.	62.38	6.41	1.21	92.0
6503	RYEGRASS, PERENNIAL	T. W. Wood & Sons, Richmond, Va.	Boyd Feed Co., Hickory, N. C.	*94.64	1.57	3.79	†62.0
6102	do	do	Farmers Union Agency Co., Winston-Salem, N. C.	96.01	.82	3.17	†42.5
6281	do	do	J. T. Turner, Asheboro, N. C.	97.32	.86	1.82	†50.0
6540	OATGRASS, TALL	S. T. Beveridge & Co., Richmond, Va.	J. H. Ditmore, Bryson City, N. C.	74.36	23.33	2.31	†59.0
6395‡	do (*Wild onion.*)	N. R. Savage & Son, Richmond, Va.	J. E. Sloop, Statesville, N. C.				
6204	do (*Quack grass.*)	T. W. Wood & Sons, Richmond, Va.	Cline & Moose, Concord, N. C.	87.65	9.84	2.51	†54.5
6295	do	do	Farmers Cash & Feed Store, Winston-Salem, N. C.	79.43	12.11	8.46	†66.0
6277	do	do	J. F. Fulton, Greensboro, N. C.	83.43	12.42	4.15	†63.5
6205	do (*Wild onion.*)	do	Gaston Seed & Prov. Co., Gastonia, N. C.	72.56	15.73	11.71	†40.5
6394	do	do	do	*64.28	21.21	14.51	74.0

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2807	do (*Cheat.*)	do	Grant's Pharmacy, Asheville, N. C.	83.54	9.39	7.07	43.5
6099	do (*Cheat.*)	do	W. A. Leslie, Morganton, N. C.	83.53	13.29	3.18	†35.0
6098	do	do	S. L. Owen & Co., Lexington, N. C.	92.72	7.08	.20	†59.5
6539	do	do	Sylva Supply Co., Sylva, N. C.	87.37	11.64	.99	79.5
6568	MILLET, GERMAN (*Wild carrot.*)	J. J. Buffington & Co., Baltimore, Md.	W. S. White & Co., Elizabeth City, N. C.	99.08	.52	.40	86.0
2910	do	Carter, Venable & Co., Richmond, Va.	E. O. McGowan, Elm City, N. C.	96.35	2.32	1.33	†52.5
6105	do	Diggs & Beadles, Richmond, Va.	Thomasville Drug Co., Thomasville, N. C.	95.07	4.38	.55	93.5
6505	do	N. R. Savage & Son, Richmond, Va.	City Feed Co., Hickory, N. C.	99.10	.63	.27	†79.0
6403	do	do	Geo. Moose, Newton, N. C.	97.90	1.92	.18	†55.0
6106	do	T. W. Wood & Sons, Richmond, Va.	Carolina Warehouse, Greensboro, N. C.	98.83	.75	.42	†58.0
6457	do	do	S. E. Dilday, Ahoskie, N. C.	96.48	3.14	.38	†69.5
6567	do	do	Wilson Drug Co., Wilson, N. C.	98.81	.06	.33	89.5
6506	do		L. R. Stricker, Asheville, N. C.	98.65	.55	.80	†26.0
6559	MILLET, PEARL	Robert Buist & Co., Philadelphia, Pa.	Doane Herring, Wilson, N. C.	98.84	1.16	.....	84.0
6560	do	do	Hood & Grantham, Dunn, N. C.	*97.90	2.10	.....	89.0
6561	do	D. Landreth Seed Co., Bristol, Pa.	Henry Dunn, Kinston, N. C.	*98.33	1.67	.....	91.0
2998‡	do	T. W. Wood & Sons, Richmond, Va.	Hardy Drug Co., Washington, N. C.				
6350	do	do	T. N. Waters & Bro., Goldsboro, N. C.	*98.25	1.75	.....	88.5
6562	do	do	Williams Drug Store, Goldsboro, N. C.	*97.94	2.06	.....	88.5
6510	OATS	Adams Grain & Prov. Co., Asheville, N. C.	J. H. Ditmore, Bryson City, N. C.	*96.54	2.43	1.03	95.0
6511	do	do	Sylva Cash Store, Sylva, N. C.	97.61	2.39	.....	95.0
6478	do (*Wild mustard.*)	Adams Grain & Prov. Co., Nashville, Tenn.	W. S. Ashworth & Sons, Brevard, N. C.	*95.27	3.45	1.28	95.9
6516	do	do	J. C. Cole, Canton, N. C.	*96.63	2.89	.48	92.0
6434	do	Adams Grain & Prov. Co., Norfolk, Va.	Bellamy & Co., Enfield, N. C.	*92.76	6.60	.64	98.5
6435	do	do	do	*97.23	.92	1.85	†86.0

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TABLE XII.—RESULTS OF TESTS OF 28 KINDS OF AGRICULTURAL SEEDS, 727 SAMPLES IN ALL, COLLECTED BY INSPECTORS FROM JULY 15, 1913 TO JULY 15, 1914—CONTINUED.

Laboratory Number	Kind of Seed and Name of Unlawful Seed Present	Wholesale Dealer	Retail Dealer	Per Cent of Pure Seed	Per Cent of Inert Matter	Per Cent of Foreign Seed	Per Cent of Germination
6333	MILLET, PEARL (*Wild mustard.*)	Adams Grain and Prov. Co., Norfolk, Va.	R. C. Carmon & Son, Ayden, N. C.	*95.65	2.41	1.94	†67.0
6247	do	do	Chadbourn Grocery Co., Chadbourn, N. C.	*95.94	1.27	2.79	†79.5
6436	do	do	W. S. Clarke & Sons, Tarboro, N. C.	*90.47	7.45	2.08	†78.0
6437	do	do	do	*96.58	3.24	.18	97.5
6438	do	do	Geo. S. Edwards, Rocky Mount, N. C.	*90.98	8.11	.91	97.5
6178	do	do	Florence Mills, Forest City, N. C.	98.19	1.04	.77	†81.5
6439	do	do	McKinne Bros. & Co., Louisburg, N. C.	*97.02	1.10	1.88	†79.0
6440	do	do	do	98.13	1.51	.36	99.5
6441	do	do	T. C. May & Son, Spring Hope, N. C.	*87.79	10.30	1.91	97.5
6332	do	do	H. G. Munford, Ayden, N. C.	*96.03	3.60	.37	98.5
6248	do (*Wild mustard.*)	do	C. L. Spencer, New Bern, N. C.	*96.12	2.36	1.52	98.0
6046	do	Adams Grain & Prov. Co., Richmond, Va.	Farmers Union Agency Co., Winston-Salem, N. C.	*96.84	1.22	1.94	†70.5
2958	do	do	Parham Supply Co., Henderson, N. C.	*94.96	4.45	.59	†6.5
6305	do	S. T. Beveridge & Co., Richmond, Va.	J. B. Cox, Warsaw, N. C.	98.16	1.56	.28	99.5
6306	OATS	do	J. B. Cox, Warsaw, N. C.	*96.87	2.92	.21	98.5
6359	do	do	J. N. Dellinger, Shelby, N. C.	97.65	2.03	.32	98.0
6509	do (*Corn cockle, Wild mustard.*)	do	J. H. Ditmore, Bryson City, N. C.	*91.21	8.43	.36	6.5
6047	do	do	Farmers Cash & Feed Store, Winston-Salem, N. C.	99.34	.66	.....	98.0
6330	do (*Cheat.*)	do	Hall Mercantile Co., Wallace, N. C.	98.98	.41	.61	97.0

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6407	do	do	W. T. Hancock & Co., Scotland Neck, N. C.	98.00	1.82	.18	100.0
6476	do	do	Harrison & Co., Lenoir, N. C.	*96.62	2.91	.47	96.5
6477	do	do	do	*96.69	1.79	1.52	98.5
6544	do	do	Harrison Bros. & Co., Williamston, N. C.	*94.36	5.49	.15	98.0
6222	do	do	Jas. E. Jordan, Dunn, N. C.	*97.35	2.18	.47	95.0
6545	do	do	C. E. Kornegay, Selma, N. C.	*90.46	7.66	1.88	†64.5
6409	do	do	Lawrence Bros., Enfield, N. C.	*96.55	3.45	.....	98.0
6307	do	do	Theo. Middleton, Magnolia, N. C.	*93.98	5.54	.48	89.5
6410	do	do	Parham Supply Co., Henderson, N. C.	*97.27	2.59	.14	98.5
6408	do	do	R. B. Peters Grocery Co., Tarboro, N. C.	*97.00	2.85	.15	97.0
6411	do	do	N. L. Stedman & Co., Halifax, N. C.	*96.54	3.20	.26	99.5
6453	do *(Cheat.)*	Carter, Venable & Co., Richmond, Va.	Lynn-Winston Co., Oxford, N. C.	97.57	2.17	.26	95.5
6454	do *(Corn cockle, Cheat.)*	do	do	*96.42	3.26	.32	98.0
6455	do	do	do	*97.38	2.59	.03	90.5
6456	do *(Cheat.)*	do	do	*94.50	3.36	2.14	96.5
6452	do *(Corn cockle, Cheat.)*	do	S. J. Stallings, Littleton, N. C.	*95.50	4.50	.....	97.5
6358	do	do	Walker's Bargain House, Mocksville, N. C.	*97.41	2.42	.17	96.5
2954	do	do	Winston-Long Co., Oxford, N. C.	*97.39	2.61	.....	95.0
6223	do	The Corbett Co., Wilmington, N. C.	J. W. Carter, Maxton, N. C.	*97.34	1.83	.83	93.0
6172	do	Diggs & Beadles, Richmond, Va.	H. M. Blackwelder, Concord, N. C.	*96.51	2.48	1.01	†58.5
6256	do *(Cheat.)*	do	J. H. Burton, Reidsville, N. C.	*81.72	13.89	4.39	†35.0
6413	do	do	Franklin Grocery Co., Franklinton, N. C.	*96.69	3.14	.17	99.5
6414	do	do	do	*93.58	3.75	2.67	†49.5
6257	do *(Corn cockle, Wild mustard.)*	do	J. F. Fulton, Greensboro, N. C.	*82.41	14.46	3.13	†47.5
6224	do	do	W. J. Glass, Concord, N. C.	*96.57	2.09	1.34	96.0
6225	do	do	do	*84.83	12.24	2.93	†34.0

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TABLE XII.—RESULTS OF TESTS OF 28 KINDS OF AGRICULTURAL SEEDS, 727 SAMPLES IN ALL, COLLECTED BY INSPECTORS FROM JULY 15, 1913 TO JULY 15, 1914—CONTINUED.

Laboratory Number	Kind of Seed and Name of Unlawful Seed Present	Wholesale Dealer	Retail Dealer	Per Cent of Pure Seed	Per Cent of Inert Matter	Per Cent of Foreign Seed	Per Cent of Germination
6415	Oats (*Wild mustard, Cheat.*)	Diggs & Beadles, Richmond, Va.	Horner Bros., Oxford, N. C.	*84.14	15.27	4.59	†42.5
6416	do	do	do	*96.19	3.56	.25	96.5
6302	do	Dixon & Etheridge, Goldsboro, N. C.	M. J. Best & Son, Goldsboro, N. C.	*94.76	4.29	.97	97.0
6316	do	do	Ray Dawson, Kinston, N. C.	98.54	1.32	.14	99.0
6317	do (*Cheat.*)	do	do	*95.49	4.51	.02	96.0
6546	do	do	do	98.12	1.98	.....	99.0
6300	do	do	Deans & Moye Co., Goldsboro, N. C.	*97.28	2.58	.14	97.5
6301	do	do	Z. M. L. Jeffreys, Goldsboro, N. C.	*95.90	3.43	.67	90.0
6315	do	do	E. S. Mewborn, La Grange, N. C.	*93.41	5.61	.98	†65.5
6327	do	do	Mt. Olive Grocery and Hardware Co., Mt. Olive, N. C.	97.51	2.25	.24	97.5
6299	do	do	Thompson & Sons, Goldsboro, N. C.	*91.97	7.86	.17	95.5
6250	do	D. L. Gore, Wilmington, N. C.	Lonlenon & Lonlenon, Chadbourn, N. C.	*97.29	2.10	.61	93.0
6328	do (*Cheat.*)	Hall & Pearsall, Wilmington, N. C.	C. Harrell & Son, Burgaw, N. C.	*95.96	3.51	.54	98.5
6329	do	do	Wallace Grocery Co., Wallace, N. C.	*96.43	3.57	.....	98.5
6514	do	Hardin, Hamilton & Lewman, Louisv., Ky.	Madison County Farmers Union, Marshall, N. C.	*95.41	4.57	.02	96.5
6228	do (*Wild onion.*)	Harsh Grain Co., Nashville, Tenn.	McRae Grocery Co., Rockingham, N. C.	*96.38	3.50	.12	98.5
6312	do	E. G. Hines, Goldsboro, N. C.	Aman Grocery Co., Clinton, N. C.	97.87	2.04	.09	98.0
6303	do	do	M. J. Best & Son, Goldsboro, N. C.	*95.91	2.68	1.41	95.0
6304	do	do	Hobbs & Russ, Warsaw, N. C.	*94.43	4.26	1.31	98.5

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6314	do	do	T. W. Pace, La Grange, N. C.	98.17	1.83		95.5
6311	do	do	J. C. Peterson, Clinton, N. C.	97.63	2.19	.18	95.0
6313	do	do	B. F. Powell, Clinton, N. C.	93.64	1.36		100.0
6221	do	do	Selma Supply Co., Selma, N. C.	*91.04	8.28	.63	94.5
6231	do (*Wild mustard.*)	Logan & Co., Nashville, Tenn.	W. M. Sanders, Smithfield, N. C.	*95.28	2.89	1.85	93.0
6425	do (*Wild mustard.*)	Mayo Milling Co., Richmond, Va.	Arrington-Bissett Co., Nashville, N. C.	*96.72	1.77	1.51	89.5
6323	do	do	Geo. D. Best & Sons, Fremont, N. C.	*91.71	7.54	.75	92.0
6427	do	do	Cockerell & Williams Co., Nashville, N. C.	*92.12	6.22	1.66	96.5
6321	do	do	R. L. Davis & Bros., Farmville, N. C.	*87.62	12.05	.33	92.0
6423	do	do	N. B. Finch & Co., Spring Hope, N. C.	*95.86	2.89	1.25	93.0
6424	do	do	do	*91.85	6.24	1.91	97.0
6422	do	do	W. H. Griffen & Co., Spring Hope, N. C.	97.93	1.38	.69	†87.5
6322	do	do	Hooks, Ballance & Co., Fremont, N. C.	*91.68	6.45	1.87	98.5
6319	do	do	J. B. Johnston, Greenville, N. C.	*91.95	7.88	.17	89.5
6428	do (*Wild mustard.*)	do	King Cooperative Co., Nashville, N. C.	*95.92	2.13	1.95	†41.0
6429	do (*Wild mustard.*)	do	Littleton Feed & Grocery Co., Littleton, N. C.	*91.13	8.64	.23	†81.5
6426	do	do	Nash Supply Co., Nashville, N. C.	*95.82	3.12	1.06	99.5
6324	do	do	Z. M. L. Peacock, Fremont, N. C.	*88.86	9.99	1.15	†36.0
6320	do (*Wild mustard, Cheat.*)	do	L. M. Savage, Greenville, N. C.	*89.45	9.62	.93	†58.0
6421	do	do	T. L. Warsley, Rocky Mount, N. C.	*90.07	8.07	1.86	96.0
6480	do	do	Williams & Erwin, Rutherfordton, N. C.	*93.22	6.57	.21	90.5
6249	do (*Cheat.*)	J. A. Meadows, New Bern, N. C.	Chas. B. Hill, New Bern, N. C.	*96.19	3.32	.49	96.0
6318	do	do	T. W. Mewborn & Co., Kinston, N. C.	*96.39	3.51	.10	93.0
6547	do	D. P. Reid & Bro., Norfolk, Va.	A. L. Owen, Plymouth, N. C.	*95.20	4.66	.14	97.5
6548	do	do	H. C. Prevatt, Edenton, N. C.	*91.46	5.99	2.55	89.5
6420	do	W. F. Richardson, Jr., & Co., Richm, Va.	Bellamy Co., Enfield, N. C.	*96.89	2.27	.84	98.5

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Laboratory Number	Kind of Seed and Name of Unlawful Seed Present	Wholesale Dealer	Retail Dealer	Per Cent of Pure Seed	Per Cent of Inert Matter	Per Cent of Foreign Seed	Per Cent of Germination
6419	OATS	W. F. Richardson, Jr., & Co., Richmond, Va.	Curtis Pierce & Co., Enfield, N. C.	*96.33	2.50	1.17	99.5
6433	do	Roper & Co., Petersburg, Va.	J. W. & D. S. Fuller, Oxford, N. C.	*87.45	5.87	6.68	92.0
6430	do	do	Eugene Johnson, Littleton, N. C.	*97.17	.95	1.88	97.5
6432	do (*Cheat.*)	do	R. S. Montague, Oxford, N. C.	*88.55	11.13	.32	†75.5
6431	do	do	L. J. Moore, Weldon, N. C.	*95.73	4.17	.10	98.5
6286	do	N. R. Savage & Son, Richmond, Va.	J. J. Adams Sons Co., Winston-Salem, N. C.	*96.03	3.80	.17	100.0
6287	do	do	do	*96.89	2.71	.40	97.0
6218	do	do	Austin-Stephens Co., Smithfield, N. C.	*95.26	2.45	2.29	90.5
6442	do	do	Beacom Supply Co., Henderson, N. C.	*96.28	3.50	.22	98.0
2956	do	do	J. D. Brooks, Oxford, N. C.	98.74	1.26	.....	†84.5
2957	do	do	Carlton-Hackney Drug Co., Durham, N. C.	99.30	.70	.....	92.0
6479	do	do	City Feed Co., Hickory, N. C.	97.89	2.02	.09	99.5
6445	do	do	Edwards & Co., Scotland Neck, N. C.	*96.47	3.38	.15	98.5
6446	do	do	do	98.48	1.35	.17	98.0
6284	do	do	Farmers Union Agency Co., Winston-Salem, N. C.	*96.92	2.93	.15	100.0
6285	do (*Cheat, Corn cockle, Wild onion.*)	do	do	*96.41	.90	2.69	94.0
6450	do	do	J. W. & D. S. Fuller, Oxford, N. C.	98.57	1.10	.33	99.0
6451	do	do	do	98.06	1.85	.09	100.0
6258	do	do	J. F. Fulton, Greensboro, N. C.	98.48	1.33	.19	98.5

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6259	do	do	do	97.82	1.93	.25	92.0
6360	do	do	Harris & McNeely, Mooresville, N. C.	*94.17	3.49	2.34	95.5
6361	do	do	do	98.60	1.32	.08	100.0
6362	do	do	do	98.21	1.79		95.0
6216	do	do	Hasell & Mims, Reidsville, N. C.	98.96	1.04		97.0
6261	do	do	do	*96.31	3.69		89.5
6447	do	do	M. Hoffman & Bro., Scotland Neck, N. C.	*97.09	1.60	1.31	99.0
6448	do	do	do	*97.11	2.49	.40	100.0
2955	do	do	Horner Bros., Oxford, N. C.	97.58	2.42		97.5
6449	do	do	Horner Bros., Oxford, N. C.	97.97	1.97	.06	99.5
6217	do	do	W. L. Kluts, Salisbury, N. C.	97.52	1.92	.56	†86.5
6326	do (*Cheat.*)	do	E. G. Martin, Son & Co., Mt. Olive, N. C.	*95.82	1.65	2.33	99.5
6260	do	do	W. E. Merritt & Co., Mt. Airy, N. C.	*96.46	3.40	.14	98.5
6282	do (*Cheat.*)	do	Miller Grocery Co., Wilkesboro, N. C.	97.68	2.09	.23	92.5
6283	do (*Wild mustard.*)	do	do	*96.92	3.00	.08	96.5
6045	do	do	Mt. Airy Feed Store, Mt. Airy, N. C.	98.54	1.46		†79.0
6443	do	do	Parham Supply Co., Henderson, N. C.	*96.31	.93	2.76	91.0
6444	do (*Cheat, Corn cockle.*)	do	do	*96.77	3.06	.17	99.0
6141	do	do	W. M. Sanders, Smithfield, N. C.	98.86	.19	.95	93.0
6142	do (*Cheat, Corn cockle.*)	do	Selma Supply Co., Selma, N. C.	99.35	.44	.21	95.0
6220	do (*Cheat.*)	do	do	98.26	1.37	.37	95.5
6363	do	do	J. E. Sloop, Statesville, N. C.	*96.73	3.26	.01	99.5
2907	do	do	R. S. Wells, Elm City, N. C.	99.00	.62	.38	†87.0
6325	do	do	Yelverton & Bros., Fremont, N. C.	*97.36	2.24	.40	100.0
6418	do	Southern Distributing Co., Norfolk, Va.	J. P. Freeman, Windsor, N. C.	*97.36	2.64		97.5
6549	do	do	W. A. Roberson & Co., Robersonville, N. C.	*96.45	2.16	1.39	95.5

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Laboratory Number	Kind of Seed and Name of Unlawful Seed Present	Wholesale Dealer	Retail Dealer	Per Cent of Pure Seed	Per Cent of Inert Matter	Per Cent of Foreign Seed	Per Cent of Germination
6417	OATS	Southern Distributing Co., Norfolk, Va.	J. P. Williams & Bros., Ahoskie, N. C.	*95.65	3.01	1.34	97.0
6513	do (*Wild mustard.*)	W. R. Tate, Nashville, Tenn.	A. L. Plemmons, Marshall, N. C.	*94.84	2.92	2.24	91.5
6512	do	do	Sylva Supply Co., Sylva, N. C.	*96.32	3.01	.67	91.0
6229	do	do	J. L. Thompson, Dunn, N. C.	97.68	2.32	.....	95.5
6219	do	Tennessee Grain Co., Nashville, Tenn.	Johnson Bros., Dunn, N. C.	*90.56	9.43	.01	†71.5
6356	do	T. W. Wood & Sons, Richmond, Va.	J. T. Angell, Mocksville, N. C.	98.38	.39	1.23	†74.5
6357	do (*Cheat*)	do	do	98.11	1.84	.05	96.5
6353	do	do	J. B. Barnes, Taylorsville, N. C.	*95.94	3.57	.49	†88.0
6406	do (*Cheat*)	do	Burroughs Grocery Co., Warrenton, N. C.	99.23	.25	.52	89.5
6143	do	do	A. W. E. Capel, Troy, N. C.	99.15	.49	.36	95.0
6226	do	do	Cline & Moose, Concord, N. C.	*97.21	2.05	.74	98.0
6246	do	do	Walter Credle & Co., Washington, N. C.	98.12	1.64	.27	95.5
6331	do	do	Duplin Grocery Co., Wallace, N. C.	97.77	2.09	.14	99.0
6309	do	do	Geo. Edwards, Magnolia, N. C.	97.94	1.95	.11	99.5
6242	do (*Wild mustard, Cheat.*)	do	A. C. Foster, Maysville, N. C.	98.28	1.46	.26	98.0
6354	do	do	Gaston Seed & Prov. Co., Gastonia, N. C.	98.82	1.03	.15	99.0
6355	do (*Cheat.*)	do	do	*96.19	3.08	.73	97.5
6308	do	do	Roy Hill & Co., Magnolia, N. C.	97.99	1.95	.06	98.5
6310	do (*Wild mustard.*)	do	J. G. Hobbs, Clinton, N. C.	*97.01	.60	2.39	†81.0
6227	do (*Cheat, Wild onion.*)	do	A. S. Huske, Fayetteville, N. C.	*96.87	2.03	1.10	95.0

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6048	do	do	H. E. Kendall, Shelby, N. C.	*96.89	3.10	.01	99.5
6049	do	do	do	*93.75	1.17	5.08	89.5
6050	do (*Cheat, Corn cockle, Wild onion.*)	do	do	99.34	.66	.....	96.0
6175	do	do	W. L. Klutz, Salisbury, N. C.	*97.03	2.97	.....	98.0
6175	do	do	do	98.01	.21	1.78	98.5
6177	do (*Corn cockle, Cheat.*)	do	do	99.30	.70	.....	89.5
6412	do	do	McGhee-Joyner Co., Franklinton, N. C.	99.20	.79	.01	100.0
2908	do	do	E. O. McGowan, Elm City, N. C.	98.06	.41	1.53	98.5
6515	do (*Cheat, Wild onion.*)	do	Madison County Farmers Union, Marshall, N. C.	*97.17	2.76	.07	99.0
6345	do	do	T. P. Nash, Elizabeth City, N. C.	98.71	1.22	.07	100.0
6551	do	do	Roberson-Holiday Co., Robersonville, N. C.	*97.13	2.46	.41	99.0
6550	do	do	J. H. Roberson & Co., Robersonville, N. C.	98.45	1.15	.....	97.5
6144	do	do	Saunders & Co., Troy, N. C.	99.38	.62	.....	94.5
6051	do	do	C. Scott & Co., Greensboro, N. C.	97.51	2.31	.18	98.0
6052	do (*Cheat.*)	do	do	97.91	1.49	.60	†66.0
6255	do	do	C. Scott & Co., Greensboro, N. C.	98.92	.98	.10	99.5
6053	do	do	W. P. Ware, Reidsville, N. C.	99.46	.54	.....	92.0
6173	do (*Cheat.*)	do	White, Morrison, Flowe Co., Concord, N. C.	97.79	.31	1.90	98.5
6174	do	do	do	97.58	1.66	.76	†31.0
6243	do	do	W. S. White & Co., Elizabeth City, N. C.	99.05	.95	.....	97.0
6244	do	do	do	*96.87	1.90	1.23	97.0
6552	do	do	do	97.87	2.13	.....	95.0
6054	do (*Cheat.*)	Locally grown	Hickory Seed Co., Hickory, N. C.	*97.11	2.01	.88	95.0
6231	do (*Cheat.*)	do	Jno. F. McNair, Laurinburg, N. C.	*94.64	4.85	.51	93.0
6474	do	do	L. R. Stricker, Asheville, N. C.	*94.71	3.95	1.34	94.0

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TABLE XII.—RESULTS OF TESTS OF 28 KINDS OF AGRICULTURAL SEEDS, 727 SAMPLES IN ALL, COLLECTED BY INSPECTORS FROM JULY 15, 1913 TO JULY 15, 1914—CONTINUED.

Laboratory Number	Kind of Seed and Name of Unlawful Seed Present	Wholesale Dealer	Retail Dealer	Per Cent of Pure Seed	Per Cent of Inert Matter	Per Cent of Foreign Seed	Per Cent of Germination
6475	OATS..... (*Wild mustard.*)	Locally grown.....	L. R. Stricker, Asheville, N. C.....	*95.20	4.11	.69	92.0
6405	PEA, FIELD.....	J. J. Buffington & Co., Baltimore, Md.....	N. S. White & Co., Elizabeth City, N. C.	.....	.....	.....	55.5
6569	....do.....	....do.....	....do.....	.....	.....	.....	66.0
6097	RAPE.....	S. T. Beveridge & Co., Richmond, Va.....	Harrison & Co., Lenoir, N. C.....	99.64	.33	.03	92.5
2788	....do.....	....do.....	Planters Supply Co., Nashville, N. C.....	98.85	.52	.63	94.0
6347	....do.....	....do.....	T. L. & W. J. Turnage Co., Farmville, N. C.	98.57	.43	.....	95.5
2789	....do.....	....do.....	J. D. Winstead & Son, Nashville, N. C.....	99.59	.41	.....	93.5
6458	....do.....	Robert Buist Co., Philadelphia, Pa.....	R. E. L. Cook, Tarboro, N. C.....	99.19	.80	.01	98.0
6558	....do.....	....do.....	Doane Herring, Wilson, N. C.....	99.27	.63	.10	94.0
6252	....do.....	J. J. Buffington & Co., Baltimore, Md.....	T. P. Nash, Elizabeth City, N. C.....	99.41	.59	.....	98.5
6494	....do.....	Carter, Venable & Co., Richmond, Va.....	Houston & Sons, Hendersonville, N. C....	99.64	.36	.....	†85.5
2970	....do.....	....do.....	C. E. King & Sons, Durham, N. C.....	99.54	.35	.11	80.5
2783	....do.....	Diggs & Beadles, Richmond, Va.....	Deans & Moyeler, Goldsboro, N. C.....	99.43	.54	.03	93.0
2825	....do.....	....do.....	Z. M. L. Jeffreys, Goldsboro, N. C.....	99.19	.81	.....	98.0
6345	....do.....	D. Landreth Seed Co., Bristol, Pa.....	Temple Drug Co., Kinston, N. C.....	98.41	1.54	.08	90.0
6346	....do.....	Leonard Seed Co., Chicago, Ill.....	J. E. Hood & Co., Kinston, N. C.....	98.78	1.18	.04	91.5
6556	....do.....	J. B. Rice Seed Co., Cambridge, N. Y.....	J. F. Clarke, New Bern, N. C.....	99.41	.59	.....	89.5
6241	....do.....	....do.....	A. S. Huske, Fayetteville, N. C.....	99.70	.30	.....	92.0
6557	....do.....	....do.....	....do.....	99.65	.32	.03	†87.5
6348	....do.....	....do.....	J. M. Lewis, Mt. Olive, N. C.....	*98.47	.46	.07	96.0

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6459	....do	....do	W. W. Parker, Henderson, N. C.	99.39	.61		90.5
6349	....do	....do	T. N. Waters & Bro., Goldsboro, N. C.	98.65	.35		91.5
6388	....do	N. R. Savage & Son, Richmond, Va.	Gaston Seed & Prov. Co., Gastonia, N. C.	99.15	.84	.01	97.0
2860	....do	....do	Parson Drug Co., Wadesboro, N. C.	99.91	.07	.02	*20.0
6387	....do	....do	J. E. Sloop, Statesville, N. C.	98.57	1.43		97.0
2822	....do	T. W. Wood & Sons, Richmond, Va.	L. H. Caldwell, Lumberton, N. C.	99.51	.49		93.5
2988	....do	....do	R. E. L. Cook, Tarboro, N. C.	99.21	.79		99.5
2781	....do	....do	Geo. E. Daniels, Goldsboro, N. C.	99.16	.76	.08	92.0
2824	....do	....do	A. J. Floyd, Fairmont, N. C.	99.65	.35		93.0
2823	....do	....do	M. W. Floyd, Lumberton, N. C.	99.42	.52	.06	96.0
6278	....do	....do	J. F. Fulton, Greensboro, N. C.	99.44	.52	.04	96.5
6196	....do	....do	Gaston Seed & Prov. Co., Gastonia, N. C.	99.80	.20		†81.5
2989	....do	....do	J. E. Hood & Co., Kinston, N. C.	98.60	1.05	.35	98.0
2990	....do	....do	A. S. Huske, Fayetteville, N. C.	99.57	.43		91.5
6342	....do	....do	Isbel & Peele, La Grange, N. C.	*98.47	.53		95.0
6341	....do	....do	J. B. Johnston, Greenville, N. C.	98.75	1.25		93.0
6555	....do	....do	H. C. Joyner, Rocky Mount, N. C.	99.32	.68		99.5
6195	....do	....do	W. L. Kluts, Salisbury, N. C.	99.16	.84		95.0
2987	....do	....do	Lucas & Bass Co., Lucama, N. C.	99.10	.90		97.5
6214	....do	....do	Miller-McLean Supply Co., Statesville, N. C.	99.38	.62		98.0
6386	....do	....do	....do	*98.30	.67	.03	97.5
6343	....do	....do	B. F. Powell, Clinton, N. C.	98.54	.46		94.0
6096	....do	....do	C. Scott & Co., Greensboro, N. C.	99.55	.45		†85.0
6344	....do	....do	Wallace Grocery Co., Wallace, N. C.	99.70	.30		95.0
2782	....do	....do	T. W. Waters & Bro., Goldsboro, N. C.	99.47	.53		94.5
2821	....do	....do	Whitakers Pharmacy, Whitakers, N. C.	99.64	.34	.02	96.0

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TABLE XII.—RESULTS OF TESTS OF 28 KINDS OF AGRICULTURAL SEEDS, 727 SAMPLES IN ALL, COLLECTED BY INSPECTORS FROM JULY 15, 1913 TO JULY 15, 1914—CONTINUED.

Laboratory Number	Kind of Seed and Name of Unlawful Seed Present	Wholesale Dealer	Retail Dealer	Per Cent of Pure Seed	Per Cent of Inert Matter	Per Cent of Foreign Seed	Per Cent of Germination
6553	RAPE	T. W. Wood & Sons, Richmond, Va.	W. S. White & Co., Elizabeth City, N. C.	*97.49	2.32	.19	89.5
6554	....do	....do	Williams Drug Co., Goldsboro, N. C.	99.45	.48	.07	93.5
6340	....do	....do	W. V. Williams, Goldsboro, N. C.	98.99	1.01	.....	96.0
2871	....do	....do	Wolfe Drug Co., Waxhaw, N. C.	99.45	.51	.04	92.0
6508	....do	.....	L. R. Stricker, Asheville, N. C.	99.25	.55	.20	*81.0
6298	REDTOP	S. T. Beveridge & Co., Richmond, Va.	J. J. Adams Sons Co., Winston-Salem, N. C.	*88.94	9.69	1.82	87.5
6055	....do	....do	Harrison & Co., Lenoir, N. C.	92.55	6.76	.69	85.5
6253	....do	J. J. Buffington & Co., Baltimore, Md.	T. P. Nash, Elizabeth City, N. C.	*46.46	21.75	31.79	89.8
6574	....do	....do	....do	*46.17	20.56	33.27	89.8
2995	....do	Diggs & Beadles, Richmond, Va.	A. S. Huske, Fayetteville, N. C.	93.21	5.91	.88	80.8
6537	....do	Hackney, Broyles & Lackey Co., Knoxville, Tenn.	R. H. Hyatt & Co., Murphy, N. C.	*69.67	21.61	8.72	81.5
2791	....do	Hardin, Hamilton & Lewman, Louisv., Ky.	Byers Bros., Hendersonville, N. C.	89.62	9.25	1.13	70.5
2803	....do	....do	Hunter Pharmacy, Hendersonville, N. C.	92.17	6.63	1.20	74.3
6060	....do	....do	C. Scott & Co., Greensboro, N. C.	*81.51	13.02	5.47	90.0
2805	....do	Louisville Seed Co., Louisville, Ky.	Grant's Pharmacy, Asheville, N. C.	91.39	7.89	.72	84.0
2804	....do	....do	R. H. Hyatt & Co., Murphy, N. C.	95.13	4.68	.19	81.0
6061	....do	N. R. Savage & Co., Richmond, Va.	C. Call, N. Wilkesboro, N. C.	*84.27	11.14	4.59	91.5
6274	....do	....do	Hasell & Mims, Reidsville, N. C.	91.75	8.05	.20	93.3
6392	....do	....do	George Moose, Newton, N. C.	89.98	9.75	.27	90.5

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2786	....do	....do	Mt. Airy Feed Store, Mt. Airy, N. C.	*83.69	11.49	4.82	79.5
6062	....do	....do	....do	*79.18	14.87	5.95	80.0
6273	....do	....do	....do	*69.38	18.26	12.46	93.0
6498	....do	Wm. G. Scarlett & Co., Baltimore, Md.	Shuping & Poteat, Morganton, N. C.	*83.15	16.12	.73	87.5
2868	....do	T. W. Wood & Sons, Richmond, Va.	F. B. Ashcraft, Monroe, N. C.	95.74	3.83	.43	76.3
6058	....do	....do	Carolina Warehouse, Greensboro, N. C.	93.80	4.26	1.94	86.3
6191	....do	....do	Cline & Moose, Concord, N. C.	95.25	4.28	.47	89.3
6495	....do	....do	Farmers Hardware & Supply Co., Hendersonville, N. C.	*82.59	16.54	.87	87.5
6057	....do	....do	Farmers Union Agency Co., Winston-Salem, N. C.	95.09	4.72	.19	87.8
6090	....do	....do	Gaston Seed and Prov. Co., Gastonia, N. C.	95.28	4.13	.59	85.0
6393	....do	....do	....do	*78.20	18.92	2.88	89.5
6056	....do	....do	W. A. Leslie, Morganton, N. C.	95.44	4.00	.56	81.8
6207	....do	....do	W. M. Neel & Co., Mooresville, N. C.	95.83	3.61	.56	85.5
6059	....do	....do	S. L. Owen & Co., Lexington, N. C.	95.72	3.90	.38	88.3
6538	....do	....do	Sylva Supply Co., Sylva, N. C.	90.28	9.53	.19	95.0
6192	....do	....do	Union Warehouse, Salisbury, N. C.	95.94	3.48	.58	86.0
6163	....do	....do	Wilkins, Ricks & Co., Sanford, N. C.	95.30	4.41	.29	86.5
6496	....do		T. S. Morrison & Co., Asheville, N. C.	*78.45	7.55	14.00	90.0
6497	....do		Slayden, Fakes & Co., Asheville, N. C.	*71.60	13.80	14.60	88.5
6030	RYE (*Cheat.*)	Adams Grain & Prov. Co., Norfolk, Va.	R. E. Campbell, Shelby, N. C.	*95.65	2.80	1.55	†62.5
6029	....do (*Cheat.*)	....do	W. B. Palmers' Sons, Shelby, N. C.	*95.18	3.37	1.45	†74.0
6135	....do (*Cheat.*)	Adams Grain & Prov. Co., Richmond, Va.	J. H. Boone & Son, Benson, N. C.	*95.36	2.96	1.68	†80.5
6028‡	....do (*Cheat, Corn cockle.*)	....do	Farmers Union Agency Co., Winston-Salem, N. C.				
6136	....do (*Cheat.*)	....do	Mt. Gilead Store Co., Mt. Gilead, N. C.	*93.75	4.34	1.91	†75.0

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Laboratory Number	Kind of Seed and Name of Unlawful Seed Present	Wholesale Dealer	Retail Dealer	Per Cent of Pure Seed	Per Cent of Inert Matter	Per Cent of Foreign Seed	Per Cent of Germination
6138	Rye (*Cheat, Wild mustard.*)	S. T. Beveridge & Co., Richmond, Va.	Austin-Stephens Co., Smithfield, N. C.	*95.88	3.31	.81	†71.5
2899	do (*Cheat.*)	do	Bellamy & Co., Enfield, N. C.	*93.04	6.79	.17	†87.5
2897	do (*Cheat.*)	do	H. L. Bizzell, Goldsboro, N. C.	*97.01	1.97	1.02	†69.5
6137	do (*Cheat.*)	do	N. S. Blue & Co., Raeford, N. C.	*95.09	3.24	1.67	†79.0
6025	do (*Cheat, Corn cockle.*)	do	R. E. Campbell, Shelby, N. C.	*96.77	1.67	1.56	†65.0
6186	do (*Wild mustard, Cheat.*)	do	Cline & Moose, Concord, N. C.	*96.05	2.88	1.07	†55.5
2983	do (*Cheat.*)	do	J. T. Edgerton, Kenly, N. C.	*94.97	4.82	.21	†72.0
2898	do (*Cheat.*)	do	Z. M. L. Jeffreys, Goldsboro, N. C.	*96.10	3.44	.46	†73.5
6024	do (*Cheat.*)	do	H. E. Kendall, Shelby, N. C.	*97.28	1.97	.75	†58.5
2904	do (*Cheat.*)	do	Parham Supply Co., Henderson, N. C.	*94.76	4.40	.84	†88.0
6023	do (*Cheat.*)	do	C. Scott & Co., Greensboro, N. C.	*95.26	4.31	.43	†88.0
6352	do (*Cheat.*)	do	Wallace Grocery Co., Wallace, N. C.	*95.32	4.36	.32	91.0
2896	do (*Cheat.*)	do	W. T. Williford, Rocky Mount, N. C.	*95.01	4.31	.68	†72.0
2984	do (*Cheat, Corn cockle.*)	Carter, Venable & Co., Richmond, Va.	J. C. Bryan & Co., Parmele, N. C.	*94.81	2.42	2.77	†86.0
2985	do (*Cheat.*)	do	Gray & Roebuck, Parmele, N. C.	*94.60	4.14	1.26	†89.0
2953	do (*Cheat.*)	do	H. W. & J. C. Webb, Hillsboro, N. C.	*96.00	3.52	.48	†85.5
2952	do (*Wild mustard, Cheat.*)	do	Winston-Long Co., Oxford, N. C.	*95.38	3.59	1.03	†84.0
2903	do (*Cheat.*)	Diggs & Beadles, Richmond, Va.	The Beacom Supply Co., Henderson, N. C.	*96.21	3.04	.75	†72.0
2946	do (*Cheat.*)	do	Byrd & Upchurch, Durham, N. C.	*95.33	3.78	.89	†82.0

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2947	do (*Cheat.*)	do	Horner Bros., Oxford, N. C.	°93.79	3.55	2.66	†75.0
2902	do (*Cheat.*)	do	Wilson Grocery Co., Wilson, N. C.	°92.73	3.31	3.96	†87.0
2894	do (*Cheat.*)	Mayo Milling Co., Richmond, Va.	Dozier & Griffin, Rocky Mount, N. C.	°95.87	3.36	.77	†88.5
2980	do (*Cheat.*)	do	J. R. & J. G. Moyes, Greenville, N. C.	°94.01	3.87	2.12	†70.0
6134‡	do (*Wild mustard, Quack grass, Wild oats.*)	do	W. N. Stewart, Benson, N. C.				
2895	do (*Cheat.*)	do	W. T. Williford, Rocky Mount, N. C.	°96.57	2.82	.61	93.5
2979	do	Geo. Moose, Newton, N. C.	A. E. Rankin & Co., Fayetteville, N. C.	°97.27	2.34	.39	93.0
6131	do (*Cheat.*)	W. F. Richardson, Jr., & Co., Richmond, Va.	Johnston Brothers, Charlotte, N. C.	°95.66	2.36	1.98	†88.5
2944	do (*Cheat.*)	do	McKinne Bros. Co., Louisburg, N. C.	°92.46	6.35	1.19	†84.0
2945	do (*Cheat.*)	do	J. T. Rogers & Co., Durham, N. C.	°93.13	5.97	.90	89.5
2905	do (*Cheat.*)	Roper & Co., Petersburg, Va.	W. T. Parker, Weldon, N. C.	°94.84	4.73	.43	†86.5
2949	do (*Cheat.*)	N. R. Savage & Son, Richmond, Va.	J. D. Brooks, Oxford, N. C.	°89.03	2.91	8.06	†59.5
2950	do (*Cheat.*)	do	Carlton-Hackney Drug Co., Durham, N. C.	°95.42	4.11	.47	†86.0
6140	do (*Cheat.*)	do	Carter-Underwood Co., Smithfield, N. C.	°95.21	4.17	.62	†76.0
2982	do (*Cheat, Wild mustard.*)	do	Ray Dawson, Kinston, N. C.	°95.25	3.23	1.52	†24.5
2981	do (*Cheat.*)	do	G. G. Edgerton & Son, Kenly, N. C.	°94.48	5.29	.23	89.5
2948	do (*Cheat.*)	do	J. W. & D. S. Fuller, Oxford, N. C.	°96.45	2.82	.73	†83.0
6187	do (*Cheat.*)	do	H. L. Parks & Co., Concord, N. C.	°95.93	3.32	.75	89.5
2951	do (*Cheat.*)	do	Geo. A. Rose & Co., Henderson, N. C.	98.61	.88	.51	†65.5
6139	do (*Cheat.*)	do	W. M. Sanders, Smithfield, N. C.	°90.37	3.92	5.71	†29.5
2986	do (*Cheat.*)	W. A. Simpson & Co., Baltimore, Md.	W. J. Newsom & Bro., Lucama, N. C.	98.17	1.19	.64	94.5
6027	do (*Cheat.*)	W. R. Tate, Nashville, Tenn.	Paul Webb, Shelby, N. C.	97.96	.88	1.16	91.0
6189	do (*Cheat.*)	T. W. Wood & Sons, Richmond, Va.	Gaston Seed & Prov. Co., Gastonia, N. C.	°94.82	4.34	.84	†87.5
2943	do (*Cheat.*)	do	Haywood & Boone, Durham, N. C.	°96.39	2.14	1.47	†49.0
2978‡	do (*Cheat.*)	do	A. S. Huske, Fayetteville, N. C.				

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TABLE XII.—RESULTS OF TESTS OF 28 KINDS OF AGRICULTURAL SEEDS, 727 SAMPLES IN ALL, COLLECTED BY INSPECTORS FROM JULY 15, 1913 TO JULY 15, 1914—CONTINUED.

Laboratory Number	Kind of Seed and Name of Unlawful Seed Present	Wholesale Dealer	Retail Dealer	Per Cent of Pure Seed	Per Cent of Inert Matter	Per Cent of Foreign Seed	Per Cent of Germination
2900	RYE. (*Cheat.*)	T. W. Wood & Sons, Richmond, Va.	B. D. Mann, Enfield, N. C.	*93.53	5.84	.63	†88.0
6022	do. (*Cheat.*)	do.	S. L. Owen & Co., Lexington, N. C.	*94.32	4.93	.70	†36.5
6188	do. (*Cheat.*)	do.	M. C. Rufty, Salisbury, N. C.	*95.86	3.66	.48	†32.5
6133‡	do. (*Cheat.*)	do.	W. S. Russell, Gulf, N. C.				
6132	do. (*Cheat.*)	do.	Lee Stone & Co., Sanford, N. C.	*93.74	5.83	.43	†86.0
6021	do. (*Cheat.*)	do.	W. P. Ware, Reidsville, N. C.	*93.87	5.48	.65	†81.0
6026	do. (*Corn cockle.*)	do.	Paul Webb, Shelby, N. C.	*93.77	5.99	.24	†81.0
2901	do. (*Cheat.*)	do.	R. S. Wells, Elm City, N. C.	*95.70	4.11	.19	†59.0
6533	TIMOTHY.	S. T. Beveridge & Co., Richmond, Va.	J. H. Ditmore, Bryson City, N. C.	93.88	.92	.20	94.5
6535	do.	J. Bolgiano & Son, Baltimore, Md.	Chautauqua Drug Co., Waynesville, N. C.	93.90	.96	.24	90.3
6251	do.	J. J. Buffington & Co., Baltimore, Md.	T. P. Nash, Elizabeth City, N. C.	93.99	.67	.34	†69.3
6570	do.	do.	W. S. White & Co., Elizabeth City, N. C.	98.61	.96	.43	91.5
6536	do.	Hackney, Broyles & Lackey Co., Knoxville, Tenn.	R. H. Hyatt & Co., Murphy, N. C.	99.34	.56	.10	88.8
6073	do.	Hardin, Hamilton & Lewman, Louisv., Ky.	C. Scott & Co., Greensboro, N. C.	93.67	.64	.69	96.8
6072	do.	N. R. Savage & Son, Richmond, Va.	C. Call, N. Wilkesboro, N. C.	99.23	.48	.29	91.8
6293	do.	do.	Miller Grocery Co., Wilkesboro, N. C.	98.43	1.28	.29	90.0
6070	do.	do.	Geo. Moose, Newton, N. C.	99.36	.49	.15	93.8
6402	do.	do.	do.	93.95	.81	.24	93.5
6071	do.	do.	Mt. Airy Feed Store, Mt. Airy, N. C.	97.10	1.81	1.09	†81.8

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6240	....do	Slate Seed Co., South Boston, Va.	A. S. Huske, Fayetteville, N. C.	99.03	.37	.60	92.8
6077	....do	T. W. Wood & Sons, Richmond, Va.	Beeson Hardware Co., High Point, N. C.	98.42	.59	.99	94.0
2972	....do	....do	Carlton-Hackney Drug Co., Durham, N. C.	99.63	.28	.09	88.3
6074	....do	....do	Carolina Warehouse, Greensboro, N. C.	99.27	.59	.14	93.3
6185	....do	....do	Cline & Moose, Concord, N. C.	99.17	.19	.64	94.8
6158	....do	....do	Davidson & Wolfe, Charlotte, N. C.	98.74	.34	.92	86.3
6489	....do	....do	Farmers Hardware & Supply Co., Hendersonville, N. C.	99.53	.33	.14	88.3
6075	....do	....do	Farmers Union Agency Co., Winston-Salem, N. C.	99.08	.34	.58	94.0
6183	....do	....do	Gaston Seed & Prov. Co., Gastonia, N. C.	95.59	1.16	3.25	†84.3
6213	....do	....do	Miller, McLean Supply Co., Statesville, N. C.	99.19	.24	.57	95.5
6076	....do	....do	S. L. Owen & Co., Lexington, N. C.	99.37	.48	.15	94.5
6534	....do	....do	Sylva Supply Co., Sylva, N. C.	99.34	.42	.24	90.5
6184	....do	....do	Union Warehouse, Salisbury, N. C.	99.12	.24	.64	93.0
6159	....do	....do	Wilkins, Ricks & Co., Sanford, N. C.	98.89	.53	.58	96.3
6487	....do		Grant Pharmacy, Asheville, N. C.	99.21	.51	.23	†83.5
6488	....do		T. S. Morrison & Co., Asheville, N. C.	98.06	1.26	.68	89.5
6486	....do		Slayden, Fakes & Co., Asheville, N. C.	98.95	.48	.57	90.5
6065	VETCH, WINTER (*Corn cockle.*)	S. T. Beveridge & Co., Richmond, Va.	Harrison & Co., Lenoir, N. C.	93.80	.90	.30	65.5
2967	....do (*Corn cockle.*)	J. Bolgiano & Son, Baltimore, Md.	H. W. & J. C. Webb, Hillsboro, N. C.	92.43	.12	7.45	33.0
2911	....do (*Corn cockle.*)	Diggs & Beadles, Richmond, Va.	Hadley-Harris Co., Wilson, N. C.	93.69	.15	1.16	66.0
2994	....do	....do	A. S. Huske, Fayetteville, N. C.	99.58	.42		37.5
6064	....do (*Corn cockle, Wild mustard.*)	N. R. Savage & Son, Richmond, Va.	Carolina Warehouse, Greensboro, N. C.	99.21	.31	.48	69.5
6063	....do	....do	City Feed Co., Hickory, N. C.	99.30	.68	.02	72.0
6151	....do (*Corn cockle.*)	....do	Parson Drug Co., Wadesboro, N. C.	99.54	.33	.13	78.0
6145	....do	T. W. Wood & Sons, Richmond, Va.	G. W. Allen & Son, Troy, N. C.	99.59		.41	17.0

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TABLE XII—.RESULTS OF TESTS OF 28 KINDS OF AGRICULTURAL SEEDS, 727 SAMPLES IN ALL, COLLECTED BY INSPECTORS FROM JULY 15, 1913 TO JULY 15, 1914—CONTINUED.

Laboratory Number	Kind of Seed and Name of Unlawful Seed Present	Wholesale Dealer	Retail Dealer	Per Cent of Pure Seed	Per Cent of Inert Matter	Per Cent of Foreign Seed	Per Cent of Germination
6404	VETCH, WINTER	T. W. Wood & Sons, Richmond, Va.	J. B. Barnes, Taylorsville, N. C.	98.23	.10	1.67	40.5
6067	do (*Corn cockle.*)	do	Beeson Hardware Co., High Point, N. C.	99.36	.25	.39	39.0
6148	do	do	Bridgers & Co., Charlotte, N. C.	100.00			21.5
6146	do	do	A. W. E. Capel, Troy, N. C.	99.72	.12	.16	36.0
6147	do	do	Farmers Supply Co., Charlotte, N. C.	99.08	.12	.80	37.5
6182	do	do	Gaston Seed & Prov. Co., Gastonia, N. C.	99.00	.15	.85	26.5
2968	do	do	Jos. A. Iseley & Bro., Burlington, N. C.	99.05	.07	.88	28.5
2993	do	do	Lucas & Bass Co., Lucama, N. C.	99.94		.06	27.0
6149	do (*Corn cockle.*)	do	J. A. McAuley, Mt. Gilead, N. C.	98.58	.32	1.10	48.0
6180	do (*Corn cockle.*)	do	W. A. Mauney & Bro., Kings Mountain, N. C.	96.58	.41	3.01	26.5
6215	do (*Corn cockle.*)	do	Miller-McLean Supply Co., Statesville, N. C.	98.94		1.06	31.0
6066	do	do	S. L. Owen & Co., Lexington, N. C.	99.23	.07	.70	31.0
6181	do (*Corn cockle.*)	do	Patterson Grocery Co., Kings Mountain, N. C.	97.84	.08	2.08	40.0
6179	do	do	M. C. Rufty, Salisbury, N. C.	99.84	.10	.06	33.0
6068	do (*Corn cockle.*)	do	C. Scott & Co., Greensboro, N. C.	99.54	.09	.37	37.5
2772	do (*Corn cockle.*)	do	Spence & Hollowell, Elizabeth City, N. C.	97.13	.07	2.62	30.0
6150	do	do	Wilkins, Ricks & Co., Sanford, N. C.	99.54	.10	.36	38.0

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6069	----do.....(*Corn cockle.*)	Imported seed	Hickory Seed Co., Hickory, N. C.	93.04	.57	6.39	57.5
2906	WHEAT	N. R. Savage & Son, Richmond, Va.	E. G. Davis Son & Co., Henderson, N. C.	98.65	1.28	.07	†77.0
6109	----do.....(*Corn cockle.*)	Locally grown	Hickory Seed Co., Hickory, N. C.	99.56	.39	.05	†80.5

*Below standard for purity. †Below standard for germination. ‡Sample examined for unlawful seeds; too weevil-eaten to make regular test.

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TABLE XIII. SUMMARY OF RESULTS OF TESTS OF 36 KINDS OF AGRICULTURAL SEEDS, 955 SAMPLES IN ALL, SUBMITTED BY INSPECTORS AND INDIVIDUALS FROM JULY 15, 1913, TO JULY 15, 1914.

Kind of Seed	Samples from Inspectors	Samples from Individuals	Total Samples Received	For Purity	For Germination	Purity Test: Pure Seed: Standard Per Cent	Pure Seed: Highest Per Cent	Pure Seed: Lowest Per Cent	Pure Seed: Average Per Cent	Inert Matter: Highest Per Cent	Inert Matter: Lowest Per Cent	Inert Matter: Average Per Cent	Foreign Seed: Highest Per Cent	Foreign Seed: Lowest Per Cent	Foreign Seed: Average Per Cent	Foreign Seed: Samples Containing Unlawful Weed Seeds	Germination Test: Standard Per Cent	Germination Test: Highest Per Cent	Germination Test: Lowest Per Cent	Germination Test: Average Per Cent
Alfalfa	14	14	28	25	28	96	99.73	86.49	98.47	13.43	.12	.93	5.52	.....	.60	1	80	96.5	9.5	76.91
Barley	3	.....	3	3	3	98	99.37	97.96	98.54	1.42	.63	1.09	.62	.....	.37	2	90	99.5	98.	99
Beans, Soy	.....	4	4	.....	4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	97.	81.	87.88
Beans, Velvet	.....	1	1	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	45.	.....	.....
Blue Grass, Ky.	21	13	34	34	34	80	90.04	65.19	80.00	32.24	9.58	18.97	11.02	.09	1.03	.....	45.0	65.5	8.5	45.70
Cane	2	.....	2	2	2	96	98.76	98.74	98.75	1.07	.93	1.00	.33	.17	.25	.....	80.0	62.5	20.0	41.25
Chufas	.....	2	2	.....	2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	76.0	35.0	55.50
Clover, Alsike	6	6	12	12	12	96	99.55	89.20	98.30	2.27	.05	.74	8.97	.20	2.88	.....	75	87.8	56.8	73.13
Clover, Bur	1	.....	1	1	1	.....	94.74	.....	.....	3.96	.....	.....	1.30	.....	.....	.....	.....	32.5	.....	.....
Clover, Crimson	108	23	131	127	131	98	99.73	94.37	97.36	5.40	.12	1.87	2.76	.02	.77	52	85	99.5	51.5	90.62
Clover, Japan	1	1	2	2	2	.....	96.02	90.87	93.45	1.74	.80	1.27	7.39	3.18	5.29	.....	.....	56.5	48.0	52.25
Clover, Red	82	16	98	98	98	92	99.88	67.15	97.78	8.20	.06	.95	24.65	.....	1.27	23	80	99.0	35.0	87.97
Clover, Sweet	1	2	3	3	2	.....	98.80	77.14	90.58	3.90	.51	1.84	22.35	.08	7.55	.....	.....	80.5	44.5	62.50
Clover, White	4	6	10	10	10	90	99.19	96.74	97.80	.91	.09	.49	2.81	.48	1.71	.....	75	89.3	70.0	81.54
Corn, Broom	.....	1	1	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3.0	.....	.....
Corn, Field	22	6	28	.....	28	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	94	100.0	84.0	95.13

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COTTON		5	5		5												85.0	51.0	71.20
COWPEAS		1	1		1												84.0		
EMMER		1	1		1												84.0		
FESCUE, MEADOW	1	1	2	2	2	95	98.77	98.74	98.76	1.17	1.07	1.12	.16	.09	.13		85	93.5	84.5	89.00
GRASS, BERMUDA	1	1	2	1	2		97.99			1.47			.54					46	43.0	44.50
GRASS, CRESTED DOGS-TAIL		1	1	1	1		99.97			.01			.02					71.0		
GRASS, ITALIAN RYE	4	3	7	7	7	95	99.97	85.35	96.59	3.67	.01	1.23	10.98	.02	2.18	1	80	79.0	9.0	44.00
GRASS, ORCHARD	44	7	51	51	51	70	97.27	35.65	74.66	59.79	2.34	20.63	10.84	.09	2.75	10	70	95.0	10.0	77.88
GRASS, PERENNIAL RYE	3	3	6	6	6	96	99.96	94.64	97.61	1.57	.01	.67	3.79	.03	1.73		90	88.5	42.5	65.42
GRASS, TALL OAT	11	3	14	13	13	72	92.72	64.28	82.45	23.33	2.31	12.05	14.51	.20	5.50	6	70	79.5	13.5	54.54
MILLET, GERMAN	9	5	14	14	14	90	99.17	95.07	98.15	4.38	.16	1.29	1.33	.16	.56	1	85	93.5	26.0	67.68
MILLET, PEARL	6		6	6	5	99	98.84	97.90	98.25	2.10	1.16	1.75					65	91.0	84.0	88.30
OATS	187	46	233	228	233	98	99.60	79.87	96.13	19.83	.19	3.09	8.17		.78	52	90	100.0	6.5	91.76
PEAS, CANADA FIELD	2		2		2													66.0	55.5	60.75
RAPE	48	1	49	49	49	99	99.91	97.49	99.19	2.32	.07	.64	.63		.05		90	99.5	20.0	91.52
REDTOP	33	4	37	37	37	90	95.94	46.17	85.53	21.75	3.48	9.90	33.27	.19	4.56		70	95.0	70.5	86.30
RYE	57	7	64	61	60	98	99.18	80.03	95.22	6.79	.82	3.59	8.06	.17	1.18	55	90	96.5	24.5	82.16
TIMOTHY	28	5	33	33	33	96	99.71	95.59	98.82	1.81	.19	.64	3.25	.05	.54		85	96.8	69.3	90.11
VETCH, WINTER	26	15	41	40	41		100.00	50.08	96.55	1.39		.20	48.53		3.25	24		87.0	17.0	48.47
WHEAT	2	24	26	6	26	98	99.86	98.18	99.25	1.58	.14	.68	.24		.07	2	90	97.5	74.5	87.60

NOTE.—Eleven samples of Vegetable Seeds were tested for individuals, but are not included in any of the charts.

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TABLE XIV.—THE ADULTERATION OF AGRICULTURAL SEEDS.

Laboratory Number	Kind of Seed and Number of Samples Tested	Wholesale Dealer	Retail Dealer	Adulterant	Per Cent of Adulteration
2971	ALFALFA, 14	Diggs & Beadles, Richmond, Va.	C. E. King & Sons, Durham, N. C.	Red clover	5
6238	BLUE GRASS, KY., 21	T. W. Wood & Sons, Richmond, Va.	Farmers Supply Co., Charlotte, N. C.	Canada bluegrass	11
6527	GRASS, ORCHARD, 44	Hackney, Broyles & Lackey Co., Knoxville, Tenn.	R. H. Hyatt & Co., Murphy, N. C.	Italian rye grass	8
6205	OATGRASS, TALL, 11	T. W. Wood & Sons, Richmond, Va.	Gaston Seed & Provision Co, Gastonia, N. C.	Orchard grass	8
6394	....do	....do	....do	....do	13
6433	OATS, 187	Roper & Co., Petersburg, Va.	J. W. & D. S. Fuller, Oxford, N. C.	Rye	6
6253	REDTOP, 33	J. J. Buffington & Co., Baltimore, Md.	T. P. Nash, Elisabeth City, N. C.	Timothy	31
6574	....do	....do	....do	....do	32
6537	....do	Hackney, Broyles & Lackey Co., Knoxville, Tenn.	R. H. Hyatt & Co., Murphy, N. C.	....do	7
6062	....do	N. R. Savage & Son, Richmond, Va.	Mt. Airy Feed Store, Mt. Airy, N. C.	....do	5
6273	....do	....do	....do	....do	11
6496	....do	....do	T. S. Morrison & Co., Asheville, N. C.	....do	14
6497	....do	....do	Slayden, Fakes & Co., Asheville, N. C.	....do	14
2949	RYE, 57	....do	J. D. Brooks, Oxford, N. C.	Wheat	7
6139	....do	....do	W. M. Sanders, Smithfield, N. C.	....do	5
2967	VETCH, WINTER, 26	J. Bolgiano & Son, Baltimore, Md.	H. W. & J. C. Webb, Hillsboro, N. C.	Spring Vetch	7
6069	....do	Imported Seed	Hickory Seed Co., Hickory, N. C.	....do	6

NOTE.—The above table shows 17 cases of adulteration which were found in the 727 agricultural seed samples collected by inspectors. No case is reported where an adulterant was not present to the amount of five (5) per cent.

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TABLE XV.—RESULTS OF GERMINATION TESTS OF 16 KINDS OF VEGETABLE SEEDS, 807 SAMPLES IN ALL, COLLECTED BY INSPECTORS FROM JULY 15, 1913, TO JULY 15, 1914.

Laboratory Number	Kind of Seed	Wholesale Dealer	Retail Dealer	Per Cent of Germination
3950	Beans	W. W. Barnard & Co., Chicago, Ill.	W. J. Kirkham & Co., Wilmington, N. C.	100.0
3951	....do	....do	....do	99.0
3354	....do	....do	S. W. Willis, New Bern, N. C.	95.0
3931	....do	Robert Buist Co, Philadelphia, Pa.	R. R. Bellamy, Wilmington, N. C.	100.0
3357	....do	....do	W. A. & J. G. Blount, Washington, N. C.	18.0
3998	....do	....do	S. F. Brown & Co., High Point, N. C.	60.0
3484	....do	....do	R. E. L. Cook, Tarboro, N. C.	94.0
3485	....do	....do	....do	5.0
4158	....do	....do	....do	78.0
4159	....do	....do	....do	76.0
4160	....do	....do	....do	86.0
4161	....do	....do	....do	98.0
4186	....do	....do	Davis Pharmacy, Marion, N. C.	69.0
3793	....do	....do	Fox & Lyon, Wadesboro, N. C.	99.0
3791	....do	....do	W. L. Hond & Co., Charlotte, N. C.	99.0
3792	....do	....do	....do	93.0
4208	....do	....do	Hood & Grantham, Dunn, N. C.	58.0
4059	....do	....do	M. R. Jennett, Mount Olive, N. C.	70.0
3702	....do	....do	T. C. Joyner, Franklinton, N. C.	94.5

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TABLE XV.—RESULTS OF GERMINATION TESTS OF 16 KINDS OF VEGETABLE SEEDS, 807 SAMPLES IN ALL, COLLECTED BY INSPECTORS FROM JULY 15, 1913, TO JULY 15, 1914.—CONTINUED.

Laboratory Number	Kind of Seed	Wholesale Dealer	Retail Dealer	Per Cent of Germination
3394	BEANS	D. M. Ferry & Co., Detroit, Mich.	Robinson-Ruffin Co., Tarboro, N. C.	37.0
3243	do	do	W. M. Sanders, Smithfield, N. C.	59.0
3249	do	do	Selma Drug Co., Selma, N. C.	58.0
3744	do	do	J. T. Sizemore, Oxford, N. C.	42.0
3237	do	do	W. F. Smith, Benson, N. C.	75.0
3412	do	do	Henry L. Spruill, Plymouth, N. C.	99.0
3456	do	do	D. W. Forb, Roseboro, N. C.	54.0
3450	do	do	G. T. Walton, Jacksonville, N. C.	55.0
4074	do	do	T. N. Waters & Bros., Goldsboro, N. C.	99.0
3382	do	do	Watson & Winslow, Hertford, N. C.	92.0
3423	do	do	E. K. Willis, Washington, N. C.	100.0
3673	do	do	J. D. Winstead & Son, Nashville, N. C.	83.0
3801	do	Griffith & Turner, Baltimore, Md.	Red Springs Drug Co., Red Springs, N. C.	66.0
3802	do	do	do	56.0
3833	do	Lake Shore Seed Co., Dunkirk, N. Y.	Adams Drug Co., Gastonia, N. C.	77.5
4106	do	do	W. C. Asbury, Lincolnton, N. C.	96.0
3345	do	do	J. F. Clarke, New Bern, N. C.	97.5
3510	do	do	Divers & Roper, Hertford, N. C.	92.5
3266	do	do	J. B. Fields, Fayetteville, N. C.	97.5

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3828	do	do	Hamlet Pharmacy, Hamlet, N. C.	62.0
3858	do	do	A. L. Jones, Maxton, N. C.	92.5
3634	do	do	Martin & Price Co., Mt. Olive, N. C.	95.0
3629	do	do	E. S. Mewborn, La Grange, N. C.	65.0
4040	do	do	Murray & Armstrong, Wallace, N. C.	44.0
4035	do	do	E. E. Rouse & Co., La Grange, N. C.	98.0
4050	do	do	Singstory Drug Co., Burgaw, N. C.	60.0
3370	do	do	Tom L. Smith, Plymouth, N. C.	94.0
3624	do	do	H. S. Southerland, Clinton, N. C.	90.0
3505	do	do	J. L. Stashey, Greenville, N. C.	27.5
3799	do	do	W. F. Tarlton, Wadesboro, N. C.	99.0
3339	do	do	D. W. Tart, Roseboro, N. C.	70.0
4046	do	do	W. D. Thomas & Co., Warsaw, N. C.	71.0
3500	do	do	W. S. White, Edenton, N. C.	87.5
3353	do	D. Landreth Seed Co., Bristol, Pa.	Beaufort Drug Co., Beaufort, N. C.	60.0
3429	do	do	do	96.0
4187	do	do	Brevard Hardware Co., Brevard, N. C.	99.0
3613	do	do	Henry Dunn, Kinston, N. C.	100.0
3614	do	do	do	100.0
4188	do	do	Grant's Pharmacy, Asheville, N. C.	100.0
3618	do	do	D. M. Partrick & Co., Clinton, N. C.	68.0
4110	do	do	J. H. Rudisill & Co., Lincolnton, N. C.	100.0
4111	do	do	do	99.5
3800	do	do	C. N. Simpson, Jr., Monroe, N. C.	95.0
4075	do	do	Temple Drug Co., Kinston, N. C.	96.0
3690	do	do	Thomas Bros., Henderson, N. C.	78.0

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TABLE XV.—RESULTS OF GERMINATION TESTS OF 16 KINDS OF VEGETABLE SEEDS, 807 SAMPLES IN ALL, COLLECTED BY INSPECTORS FROM JULY 15, 1914, TO JULY 15, 1914.—CONTINUED.

Laboratory Number	Kind of Seed	Wholesale Dealer	Retail Dealer	Per Cent of Germination
4165	BEANS	D. Landreth Seed Co., Bristol, Pa.	Thomas Bros., Henderson, N. C.	99.0
4166	....do	....do	....do	78.0
4164	....do	....do	Wilson Drug Co., Wilson, N. C.	92.0
3360	....do	Leonard Seed Co., Chicago, Ill.	R. R. Bellamy, Wilmington, N. C.	70.0
4071	....do	....do	M. J. Best & Son, Goldsboro, N. C.	97.0
3786	....do	....do	Charlotte Drug Co., Charlotte, N. C.	68.0
3787	....do	....do	....do	75.0
3788	....do	....do	....do	47.5
3608	....do	....do	J. E. Hood & Co., Kinston, N. C.	43.0
4068	....do	....do	....do	98.0
4069	....do	....do	....do	96.0
3270	....do	....do	A. S. Huske, Fayetteville, N. C.	25.0
3359	....do	....do	W. J. Kirkham & Co., Wilmington, N. C.	76.0
4072	....do	....do	T. H. Knowles & Co., Mt. Olive, N. C.	100.0
3636	....do	....do	Mt. Olive Grocery & Hardware Co., Mt. Olive, N. C.	79.0
4210	....do	....do	Ruffin-High Co., Wilson, N. C.	82.0
3997	....do	....do	C. Scott & Co., Greensboro, N. C.	100.0
4070	....do	....do	B. G. Thompson & Son, Goldsboro, N. C.	90.0
4073	....do	....do	T. N. Waters & Bros., Goldsboro, N. C.	100.0

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3524	do	do	W. S. White & Co., Elizabeth City, N. C.	23.0
3358	do	do	Worthy & Etheridge, Washington, N. C.	73.0
3361	do	do	Worthy & Etheridge, Washington, N. C.	75.0
4107	do	L. L. May & Co., St. Paul, Minn.	W. C. Asbury, Lincolnton, N. C.	73.0
4108	do	do	Clarence Clapp, Newton, N. C.	62.0
4109	do	do	do	54.0
3375	do	do	Divers & Roper, Hertford, N. C.	13.0
3703	do	do	F. R. Pleasants, Louisburg, N. C.	93.0
3815	do	do	E. D. Whitlocke, Rockingham, N. C.	54.0
3940	do	J. B. Rice Seed Co., Cambridge, N. Y.	Blount Pharmacy, Washington N. C.	76.0
3356	do	do	J. F. Clarke, New Bern, N. C.	81.0
3945	do	do	do	97.0
3946	do	do	do	87.0
3947	do	do	do	84.0
3582	do	do	Geo. E. Daniels, Goldsboro, N. C.	95.0
4203	do	do	do	96.0
4204	do	do	do	100.0
3355	do	do	F. S. Duffy, New Bern N. C.	99.0
3941	do	do	do	82.0
3942	do	do	do	79.0
3929	do	do	J. H. Hardin, Wilmington, N. C.	98.0
3936	do	do	do	99.0
3937	do	do	do	82.0
3938	do	do	do	99.0
3939	do	do	do	99.0
4063	do	do	C. Harrell & Son, Burgaw, N. C.	81.0

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TABLE XV.—RESULTS OF GERMINATION TESTS OF 16 KINDS OF VEGETABLE SEEDS, 807 SAMPLES IN ALL, COLLECTED BY INSPECTORS FROM JULY 15, 1913, TO JULY 15, 1914.—CONTINUED.

Laboratory Number	Kind of Seed	Wholesale Dealer	Retail Dealer	Per Cent of Germination
4064	BEANS	J. B. Rice Seed Co., Cambridge, N. Y.	C. Harrell & Son, Burgaw, N. C.	81.0
3896	do	do	A. S. Huske, Fayetteville, N. C.	68.0
3897	do	do	A. S. Huske, Fayetteville, N. C.	91.0
4205	do	do	do	97.0
4062	do	do	Z. M. L. Jeffreys, Goldsboro, N. C.	96.0
3635	do	do	Y. H. Knowles & Co., Mt. Olive, N. C.	51.0
4182	do	do	Leslie Drug Store, Morganton, N. C.	100.0
4183	do	do	do	86.0
3691	do	do	W. W. Parker, Henderson, N. C.	94.0
4156	do	do	do	92.0
4157	do	do	do	99.0
4160	do	do	J. C. Peterson, Clinton, N. C.	100.0
4001	do	do	C. Scott & Co., Greensboro, N. C.	84.5
3585	do	do	T. N. Waters & Bro., Goldsboro, N. C.	95.0
3523	do	do	W. S. White & Co., Elizabeth City, N. C.	96.0
3930	do	do	do	100.0
3943	do	do	do	95.0
3944	do	do	do	75.0

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3948	---do	Wood-Stubbs & Co., Louisville, Ky	Brown Mercantile Co., Chadbourn, N. C	96.0
3949	---do	---do	---do	96.0
4206	---do	---do	A J. Cox & Co., Washington, N. C	94.0
4207	---do	---do	H. C. Joyner, Rocky Mount, N. C	100.0
4076	---do	---do	M. W. Pope, Mt. Olive, N. C	100.0
4077	---do	---do	---do	100.0
4162	---do	---do	Tarboro Grocery Co., Tarboro, N. C	97.0
3805	---do	T. W. Wood & Sons, Richmond, Va	Barnes-Finger Drug Co., Kings Mountain, N. C	39.0
3907	---do	---do	W. H. Bowen & Son, Belhaven, N. C	96.0
4185	---do	---do	Bradsher's Pharmacy, Hendersonville, N. C	92.5
3953	---do	---do	H. A. Chadwick, Pollocksville, N. C	87.0
4194	---do	---do	Chautauqua Drug Co., Waynesville, N. C	33.0
3816	---do	---do	E. N. Covington & Co., Rockingham, N. C	100.0
3817	---do	---do	---do	94.0
3635	---do	---do	Furgerson Drug Co., Halifax, N. C	15.0
3863	---do	---do	Harris Bros., Waxhaw, N. C	93.0
4065	---do	---do	J. C. Horne, Magnolia, N. C	40.0
3271	---do	---do	A. S. Huske, Fayetteville, N. C	19.0
4066	---do	---do	J. B. Johnston, Greenville, N. C	98.0
4067	---do	---do	---do	84.0
4112	---do	---do	H. E. Kendall, Shelby, N. C	100.0
4184	---do	---do	L. A. Kincaid, Morganton, N. C	95.0
3952	---do	---do	W. J. Kirkham & Co., Wilmington, N. C	92.0
3615	---do	---do	Lenoir Drug Co., Kinston, N. C	28.5
4007	---do	---do	Mann Drug Co., High Point, N. C	41.5
4008	---do	---do	Miller Grocery Co., Wilkesboro, N. C	42.5

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TABLE XV.—RESULTS OF GERMINATION TESTS OF 16 KINDS OF VEGETABLE SEEDS, 807 SAMPLES IN ALL, COLLECTED BY INSPECTORS FROM JULY 15, 1913, TO JULY 15, 1914.—CONTINUED.

Laboratory Number	Kind of Seed	Wholesale Dealer	Retail Dealer	Per Cent of Germination
3906	BEANS	T. W. Wood & Sons, Richmond, Va.	Mitchell & Barrow, Star, N. C.	94.5
3494	....do	....do	J. A. Mitchener, Edenton, N. C.	10.0
3495	....do	....do	....do	90.0
3823	....do	....do	E. L. Rhodes, Hamlet, N. C.	100.0
3351	....do	....do	M. R. Springle, Beaufort, N. C.	23.0
3352	....do	....do	....do	73.0
3818	....do	....do	R. G. Stone, Laurinburg, N. C.	-------
3616	....do	....do	J. D. Williams, Wilson, N. C.	35.0
4163	....do	....do	Wilson Drug Co., Wilson, N. C.	58.0
3975	BEETS	W. W. Barnard & Co., Chicago, Ill.	W. J. Kirkham & Co., Wilmington, N. C.	64.0
4006	....do	....do	T. W. Waters & Bro., Goldsboro, N. C.	81.0
4004	....do	Robert Buist Co., Philadelphia, Pa.	S. F. Brown & Co., High Point, N. C.	63.0
4189	....do	....do	Davis Pharmacy Marion, N. C.	64.5
4190	....do	....do	....do	72.5
4056	....do	....do	E. B. Marston Drug Co., Kinston, N. C.	85.0
4130	....do	W. Atlee Burpee & Co., Philadelphia, Pa.	Hunter Drug Co., Warrenton, N. C.	87.5
4010	....do	Crosman Bros. Co., Rochester, N. Y.	J. J. Adams Sons & Co., Winston-Salem, N. C.	78.0
3713	....do	....do	E. T. Alford, Youngsville, N. C.	92.0
4149	....do	....do	E. S. Barrett & Co., Jackson, N. C.	87.0

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4027	---do	---do	F. Barwick, La Grange, N. C.	83.5
3845	---do	---do	Hart Drug Co., Norwood, N. C.	43.5
3835	---do	---do	Kennedy's Drug Store, Gastonia, N. C.	28.0
3811	---do	---do	Kiser & Mauney, Kings Mountain, N. C.	24.5
3693	---do	---do	W. W. Parker, Henderson, N. C.	77.5
4015	---do	---do	F. D. Scott & Son, Magnolia, N. C.	89.5
3840	---do	---do	Shankle, Snuggs Co., Albemarle, N. C.	69.5
4152	---do	---do	Herbert Smith, Littleton, N. C.	85.5
3675	---do	---do	G. T. Whitehead & Co., Scotland Neck, N. C.	82.5
4023	---do	---do	J. D. Williams, Wilson, N. C.	90.0
4019	---do	---do	W. A. Wilson, Dover, N. C.	75.5
4098	---do	D. M. Ferry & Co., Detroit, Mich.	Armour Bros. & Thompson, Davidson, N. C.	79.5
3924	---do	---do	H. L. Arnold, Vanceboro, N. C.	79.0
3879	---do	---do	U. A. Bell & Co., Dunn, N. C.	84.0
3982	---do	---do	Bruton & Co., Mt. Gilead, N. C.	75.5
3728	---do	---do	Burroughs Grocery Co., Warrenton, N. C.	80.5
3759	---do	---do	Buthers Lumber Co., Boardman, N. C.	71.5
3910	---do	---do	H. A. Chadwick, Pollocksville, N. C.	71.5
3440	---do	---do	B. B. Davenport, New Bern, N. C.	78.5
3590	---do	---do	Fitzgerald Drug Co., Rocky Mount, N. C.	77.0
4137	---do	---do	Hill Bros., Cofield, N. C.	74.0
4145	---do	---do	J. J. Madre & Bros., Windsor, N. C.	73.5
3914	---do	---do	W. J. Morgan, Oriental, N. C.	80.5
3874	---do	---do	Morrow Bros. & Heath Co., Albemarle, N. C.	64.5
3885	---do	---do	Selma Supply Co., Selma, N. C.	66.0
4141	---do	---do	W. P. Shaw, Jr. & Bros., Winton, N. C.	65.5

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TABLE XV.—RESULTS OF GERMINATION TESTS OF 16 KINDS OF VEGETABLE SEEDS, 807 SAMPLES IN ALL, COLLECTED BY INSPECTORS FROM JULY 15, 1913, TO JULY 15, 1914.—CONTINUED.

Laboratory Number	Kind of Seed	Wholesale Dealer	Retail Dealer	Per Cent of Germination
4053	BEETS	D. M. Ferry & Co., Detroit, Mich.	T. L. & W. J. Turnage Co., Farmville, N. C.	70.5
4103	do	Lake Shore Seed Co., Dunkirk, N. Y.	W. C. Asbury, Lincolnton, N. C.	86.0
3342	do	do	J. F. Clarke, New Bern, N. C.	57.5
4032	do	do	E. E. Rouse & Co., La Grange, N. C.	87.0
4042	do	do	W. D. Thomas & Co., Warsaw, N. C.	62.5
3497	do	do	W. S. White, Edenton, N. C.	50.5
4202	do	D. Landreth Seed Co., Bristol, Pa.	Beaufort Drug Co., Beaufort, N. C.	83.5
3745	do	do	Hamilton Drug Co., Oxford, N. C.	81.0
3704	do	L. L. May & Co., St. Paul, Minn.	Beasley-Austin Drug Co., Louisburg, N. C.	81.5
4134	do	do	Nash Supply Co., Nashville, N. C.	85.0
3258	do	J. B. Rice Seed Co., Cambridge, N. Y.	A. S. Huske, Fayetteville, N. C.	54.5
4095	do	do	J. M. Lewis, Mt. Olive, N. C.	91.5
4155	do	do	W. W. Parker, Henderson, N. C.	73.0
4002	do	do	C. Scott & Co., Greensboro, N. C.	80.0
3347	do	do	Worthy & Etheridge, Washington, N. C.	91.0
3976	do	do	do	76.5
3514	do	T. W. Wood & Sons, Richmond, Va.	Alexander & Blount, Plymouth, N. C.	81.5
4003	do	do	W. S. Allen, Reidsville, N. C.	76.0
3906	do	do	W. H. Bowen & Son, Belhaven, N. C.	88.5

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3902	....do	....do	M. C. Rufty, Salisbury, N. C.	88.0
4174	CABBAGE	Robert Buist Co., Philadelphia, Pa.	R. E. L. Cook, Tarboro, N. C.	74.0
3561	....do	....do	Parson Drug Co., Wadesboro, N. C.	56.5
3477	....do	....do	Reese & Alexander Inc., Charlotte, N. C.	62.5
3278	....do	....do	P. A. Thompson, Winston-Salem, N. C.	54.5
3652	....do	....do	I. W. West Drug Co., Mt. Airy, N. C.	28.5
4192	....do	Crosman Bros. Co., Rochester, N. Y.	T. B. Carson, Hendersonville, N. C.	96.0
3288	....do	....do	J. Emra Cox, Winston-Salem, N. C.	25.0
3282	....do	....do	Eford Bros., Winston-Salem, N. C.	33.0
3556	....do	....do	Fox & Lyon, Wadesboro, N, C.	22.0
3642	....do	....do	Golden Rule Drug Co., Walnut Cove, N. C.	2.5
3843	....do	....do	Hart Drug Co., Norwood, N. C.	27.5
3754	....do	....do	Lawnings Drug Store, Lincolnton, N. C.	17.0
3637	....do	....do	Madison Grocery Co., Madison, N. C.	40.0
3293	....do	....do	J. G. Messick, Winston-Salem, N. C.	16.5
3692	....do	....do	W. W. Parker, Henderson, N. C.	87.0
3647	....do	....do	The Peoples Drug Store, Mt. Airy, N. C.	7.0
4097	....do	D. M. Ferry & Co., Detroit, Mich.	Armour Bros. & Thompson, Davidson, N. C.	97.0
3878	....do	....do	N. A. Bell & Co., Dunn, N. C.	83.0
3981	....do	....do	Bruton & Co., Mt. Gilead, N. C.	86.0
3322	....do	....do	Cabarrus Drug Co., Concord, N. C.	83.0
3467	....do	....do	Charlotte Drug Co., Charlotte, N. C.	96.0
3318	....do	....do	Cook & Harris, Concord, N. C.	40.0
3325	....do	....do	Dove-Bost Co., Concord, N. C.	98.0
3530	....do	....do	English Drug Co., Monroe, N. C.	61.0
3273	....do	....do	Farmers Trade House Co., Winston-Salem, N. C.	70.5

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TABLE XV.—RESULTS OF GERMINATION TESTS OF 16 KINDS OF VEGETABLE SEEDS, 807 SAMPLES IN ALL, COLLECTED BY INSPECTORS FROM JULY 15, 1913, TO JULY 15, 1914.—CONTINUED.

Laboratory Number	Kind of Seed	Wholesale Dealer	Retail Dealer	Per Cent of Germination
3571	CABBAGE	D. M. Ferry & Co., Detroit, Mich.	L. G. Fox, Rockingham, N. C.	93.0
3540	....do	....do	Latham & Richardson, Monroe, N. C.	52.0
3306	....do	....do	J. W. McPherson & Co., Salisbury, N. C.	66.5
3873	....do	....do	Morrow Bros. & Heath Co., Albemarle, N. C.	68.5
3657	....do	....do	Mt. Airy Feed Store, Mt. Airy, N. C.	71.5
3301	....do	....do	Owens Drug Co., Winston-Salem, N. C.	80.5
3566	....do	....do	Parson Drug Co., Wadesboro, N. C.	71.0
3884	....do	....do	Selma Supply Co., Selma, N. C.	65.5
3462	....do	....do	Torrence Drug Co., Gastonia, N. C.	93.5
3535	....do	....do	Dr. S. J. Welsh & Son, Monroe, N. C.	68.0
3472	....do	....do	Woodall & Sheppard, Charlotte, N. C.	66.0
4101	....do	Lake Shore Seed Co., Dunkirk, N. Y.	W. C. Asbury, Lincolnton, N. C.	91.5
3576	....do	....do	Eagle Pharmacy, Rockingham, N. C.	30.5
3546	....do	....do	Latham Richardson, Monroe, N. C.	89.0
3749	....do	....do	Lawnings Drug Store, Lincolnton, N. C.	6.5
3551	....do	....do	Earle Morrow Drug Store, Hamlet, N. C.	66.5
3525	....do	D. Landreth Seed Co., Bristol, Pa.	English Drug Co., Monroe, N. C.	88.0
3330	....do	....do	Fetzer & Tucker, Reidsville, N. C.	65.5

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3888	....do	....do	J. T. Fields, Laurinburg, N. C.	89.0
3687	....do	....do	Grant's Pharmacy, Asheville, N. C.	86.5
3298	....do	....do	E. W. O'Hanlon, Winston-Salem, N. C.	
3364	....do	Leonard Seed Co., Chicago, Ill.	W. J. Kirkham & Co., Wilmington, N. C.	86.0
3992	....do	T. W. Wood & Sons, Richmond, Va.	W. S. Allen, Reidsville, N. C.	69.0
3315	....do	....do	Davis Drug Co., Concord, N. C.	67.5
3457	....do	....do	Gaston Seed & Provision Co., Gastonia, N. C.	99.0
3312	....do	....do	Gibson Drug Co., Concord, N. C.	89.5
3993	....do	....do	Mitchell & Barrow, Star, N. C.	69.0
4013	CELERY	Crosman Bros. Co., Rochester, N. Y.	J. J. Adams Sons & Co., Winston-Salem, N. C.	58.3
3974	SWEET CORN	W. W. Barnard & Co., Chicago, Ill.	W. J. Kirkham & Co., Wilmington, N. C.	87.0
3287	....do	Crosman Bros. Co., Rochester, N. Y.	J. Emra Cox, Winston-Salem, N. C.	97.0
3281	....do	....do	Eford Bros., Winston-Salem, N. C.	94.0
4196	....do	....do	Miller Bros., Waynesville, N. C.	90.0
4197	....do	....do	....do	55.0
3272	....do	D. M. Ferry & Co., Detroit, Mich.	Farmers Trade House Co., Winston-Salem, N. C.	76.0
3311	....do	....do	J. W. McPherson & Co., Salisbury, N. C.	77.0
4175	....do	D. Landreth Seed Co., Bristol, Pa.	Grant's Pharmacy, Asheville, N. C.	78.5
4128	....do	....do	J. H. Rudisill & Co., Lincolnton, N. C.	84.0
4091	....do	J. B. Rice Seed Co., Cambridge, N. Y.	Z. M. L. Jeffreys, Goldsboro, N. C.	98.0
4092	....do	....do	....do	93.0
4198	....do	....do	Leslie Drug Store, Morganton, N. C.	89.5
3972	....do	....do	W. S. White & Co., Elizabeth City, N. C.	84.0
3973	....do	....do	....do	94.0
3971	....do	Wood-Stubbs Co., Louisville, Ky.	Brown Mercantile Co., Chadbourn, N. C.	83.0
4087	....do	....do	M. W. Pope, Mt. Olive, N. C.	96.0

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TABLE XV.—RESULTS OF GERMINATION TESTS OF 16 KINDS OF VEGETABLE SEEDS, 807 SAMPLES IN ALL, COLLECTED BY INSPECTOR FROM JULY 15, 1913, TO JULY 15, 1914.—CONTINUED.

Laboratory Number	Kind of Seed	Wholesale Dealer	Retail Dealer	Per Cent of Germination
4176	SWEET CORN	T. W. Wood & Sons, Richmond, Va.	Bradsher's Pharmacy, Hendersonville, N. C.	82.5
4195	....do	....do	Chautauqua Drug Co., Waynesville, N. C.	94.0
4126	....do	....do	Gaston Seed & Provision Co., Gastonia, N. C.	98.5
4127	....do	....do	....do	88.0
4089	....do	....do	J. C. Horne, Magnolia, N. C.	94.0
4088	....do	....do	J. B. Johnston, Greenville, N. C.	88.0
4090	....do	....do	B. F. Powell, Clinton, N. C.	86.0
4172	....do	....do	Wilson Drug Co., Wilson, N. C.	88.0
4173	....do	....do	....do	92.0
3563	CUCUMBERS	Robert Buist Co., Philadelphia, Pa.	Parson Drug Co., Wadesboro, N. C.	69.0
4011	....do	Crosman Bros. Co., Rochester, N. Y.	J. J. Adams Sons & Co., Winston-Salem, N. C.	68.0
4100	....do	D. M. Ferry & Co., Detroit, Mich.	Armour Bros. & Thompson, Davidson, N. C.	70.0
3984	....do	....do	Bruton & Co., Mt. Gilead, N. C.	83.0
3875	....do	....do	Morrow Bros. & Heath Co., Albemarle, N. C.	72.0
3886	....do	....do	Selma Supply Co., Selma, N. C.	88.5
3891	....do	D. Landreth Seed Co., Bristol, Pa.	J. T. Fields, Laurinburg, N. C.	79.5
3995	....do	T. W. Wood & Sons, Richmond, Va.	Mitchell & Barrow, Star, N. C.	88.0
3683	LETTUCE	J. Bolgiano & Son, Baltimore, Md.	E. Clarke, Weldon, N. C.	3.0
3488	....do	Robert Buist Co., Philadelphia, Pa.	R. E. L. Cook, Tarboro, N. C.	95.0

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4057	....do	....do	E. B. Marston Drug Co., Kinston, N. C.	89.5
3601	....do	....do	Temple Drug Co., Kinston, N. C.	97.0
4131	....do	W. Atlee Burpee & Co., Philadelphia, Pa.	Hunter Drug Co., Warrenton, N. C.	96.5
4009	....do	Crosman Bros. Co., Rochester, N. Y.	J. J. Adams Sons & Co., Winston-Salem, N. C.	48.0
3714	....do	....do	E. T. Alford, Youngsville, N. C.	68.5
3781	....do	....do	J. L. Bailey, Elm City, N. C.	99.5
3776	....do	....do	Barnes Bros., Proctorville, N. C.	98.5
4150	....do	....do	E. S. Barrett & Co., Jackson, N. C.	5.5
4028	....do	....do	F. Barwick, LaGrange, N. C.	56.5
3849	....do	....do	E. L. Burns, Maxton, N. C.	65.5
3720	....do	....do	Wells Dilery, Roanoke Rapids, N. C.	34.5
3836	....do	....do	Kennedy's Drug Store, Gastonia, N. C.	98.0
3812	....do	....do	Kiser & Mauney, Kings Mountain, N. C.	92.0
3694	....do	....do	W. W. Parker, Henderson, N. C.	35.5
4016	....do	....do	F. D. Scott & Son, Magnolia, N. C.	3.5
3841	....do	....do	Shankle, Snuggs Co., Albemarle, N. C.	11.0
4153	....do	....do	Herbert Smith, Littleton, N. C.	96.5
3676	....do	....do	G. T. Whitehead & Co., Scotland Neck, N. C.	32.5
4024	....do	....do	J. D. Williams, Wilson, N. C.	25.5
4020	....do	....do	W. A. Wilson, Dover, N. C.	53.0
3925	....do	D. M. Ferry & Co., Detroit, Mich.	H. L. Arnold, Vanceboro, N. C.	76.0
3808	....do	....do	Barnes-Finger Drug Co., Kings Mountain, N. C.	74.5
3880	....do	....do	W. A. Bell & Co., Dunn, N. C.	99.0
3983	....do	....do	Bruton & Co., Mt. Gilead, N. C.	98.0
3729	....do	....do	Burroughs Grocery Co., Warrenton, N. C.	52.5
3760	....do	....do	Buthers Lumber Co., Boardman, N. C.	99.0

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TABLE XV.—RESULTS OF GERMINATION TESTS OF 16 KINDS OF VEGETABLE SEEDS, 807 SAMPLES IN ALL, COLLECTED BY INSPECTORS FROM JULY 15, 1913, TO JULY 15, 1914.—CONTINUED.

Laboratory Number	Kind of Seed	Wholesale Dealer	Retail Dealer	Per Cent of Germination
3911	LETTUCE	D. M. Ferry & Co., Detroit, Mich.	H. A. Chadwick, Pollocksville, N. C.	98.0
3229	do	do	A. J. Cook & Co., Fayetteville, N. C.	96.5
3918	do	do	Walter Credle & Co., Washington, N. C.	70.5
3441	do	do	B. B. Davenport, New Bern, N. C.	86.0
3735	do	do	S. J. Dilday, Ahoskie, N. C.	56.0
3591	do	do	Fitzgerald Drug Co., Rocky Mount, N. C.	98.0
3698	do	do	Franklin Grocery Co., Franklinton, N. C.	97.5
3664	do	do	Harrison & Hill Drug Co., Enfield, N. C.	77.5
4138	do	do	Hill Bros., Cofield, N. C.	93.5
3392	do	do	F. V. Johnston, Greenville, N. C.	96.0
4146	do	do	J. J. Madre & Bro., Windsor, N. C.	86.0
3915	do	do	W. J. Morgan, Oriental, N. C.	99.0
3419	do	do	J. B. Morton, Morehead City, N. C.	77.5
3435	do	do	Potter Bros., Beaufort, N. C.	53.0
3402	do	do	J. H. Roberson & Co., Robersonville, N. C.	98.0
3408	do	do	Theo. Roberson & Co., Williamston, N. C.	92.0
3253	do	do	Robinson Bros., Dunn, N. C.	90.5
3396	do	do	Robinson-Ruffin Co., Tarboro, N. C.	34.5
3241	do	do	W. M. Sanders, Smithfield, N. C.	94.0

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3247	do	do	Selma Drug Co., Selma, N. C.	93.0
4142	do	do	W. P. Shaw, Jr. & Bro., Winton, N. C.	100.0
3741	do	do	J. T. Sizemore, Oxford, N. C.	98.5
3235	do	do	W. F. Smith, Benson, N. C.	95.0
3414	do	do	Henry L. Spruill, Plymouth, N. C.	97.5
3861	do	do	Standard Store Co., Aberdeen, N. C.	90.5
3453	do	do	D. W. Tart, Roseboro, N. C.	97.5
4054	do	do	T. L. & W. J. Turnage Co., Farmville, N. C.	98.0
3447	do	do	G. T. Walton & Son, Jacksonville, N. C.	98.5
3386	do	do	Watson & Winslow, Hertford, N. C.	44.5
3426	do	do	E. K. Willis, Washington, N. C.	79.5
3670	do	do	J. D. Winstead & Son, Nashville, N. C.	64.0
3831	do	Lake Shore Seed Co., Dunkirk, N. Y.	Adams Drug Co., Gastonia, N. C.	55.0
3343	do	do	J. F. Clarke, New Bern, N. C.	58.0
3503	do	do	Divers & Roper, Hertford, N. C.	95.5
3264	do	do	J. B. Fields, Fayetteville, N. C.	17.5
3826	do	do	Hamlet Pharmacy, Hamlet, N. C.	40.5
3855	do	do	A. L. Jones, Maxton, N. C.	87.0
3632	do	do	Martin & Price Co., Mt. Olive, N. C.	43.5
3627	do	do	E. S. Mewborn, La Grange, N. C.	85.0
4037	do	do	Murray & Armstrong, Wallace, N. C.	90.5
4031	do	do	E. E. Rouse & Co., La Grange, N. C.	96.5
4048	do	do	Singletary Drug Co., Burgaw, N. C.	72.0
3372	do	do	Tom L. Smith, Plymouth, N. C.	51.5
3621	do	do	H. S. Southerland, Clinton, N. C.	77.5
3503	do	do	J. L. Stashey, Greenville, N. C.	51.0

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TABLE XV.—RESULTS OF GERMINATION TESTS OF 16 KINDS OF VEGETABLE SEEDS, 807 SAMPLES IN ALL, COLLECTED BY INSPECTORS FROM JULY 15, 1913, TO JULY 15, 1914.—CONTINUED.

Laboratory Number	Kind of Seed	Wholesale Dealer	Retail Dealer	Per Cent of Germination
3796	LETTUCE	Lake Shore Seed Co., Dunkirk, N. Y.	V. F. Tarlton, Wadesboro, N. C.	25.0
3337	do	do	D. W. Tart, Roseboro, N. C.	99.0
4043	do	do	W. D. Thomas & Co., Warsaw, N. C.	98.0
3498	do	do	W. S. White, Edenton, N. C.	18.0
3703	do	D. Landreth Seed Co., Bristol, Pa.	Aycock Drug Co., Louisburg, N. C.	94.0
4200	do	do	Beaufort Drug Co., Beaufort, N. C.	98.0
3611	do	do	Henry Dunn, Kinston, N. C.	97.0
3821	do	do	J. T. Fields, Laurinburg, N. C.	77.0
3746	do	do	Hamilton Drug Co., Oxford, N. C.	92.5
3517	do	do	Roberson, Cory & Co., Robersonville, N. C.	
3520	do	do	W. S. White & Co., Elizabeth City, N. C.	70.0
3705	do	L. L. May & Co., St. Paul, Minn.	Beasley-Austin Drug Co., Louisburg, N. C.	93.5
3377	do	do	Divers & Roper, Hertford, N. C.	85.0
3597	do	do	Kyser's Drug Store, Rocky Mount, N. C.	93.5
3259	do	Jerome B. Rice Seed Co., Cambridge, N. Y.	A. S. Huske, Fayetteville, N. C.	89.0
3512	do	T. W. Wood & Sons, Richmond, Va.	N. S. Blanchard & Son, Hertford, N. C.	95.0
3491	do	do	J. A. Mitchener, Edenton, N. C.	97.5
3362	MUSKMELON	Robert Buist Co., Philadelphia, Pa.	R. R. Bellamy, Wilmington, N. C.	78.5
3480	do	do	Reese & Alexander, Inc., Charlotte, N. C.	81.0

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3655	do	do	I. W. West Drug Co., Mt. Airy, N. C.	77.0
3656	do	do	do	74.0
3291	do	Crosman Bros. Co., Rochester, N. Y.	J. Emra Cox, Winston-Salem, N. C.	39.0
3285	do	do	Eford Bros., Winston-Salem, N. C.	84.0
3559	do	do	Fox & Lyon, Wadesboro, N. C.	15.0
3645	do	do	Golden Rule Drug Co., Walnut Cove, N. C.	92.0
3756	do	do	Lawnings Drug Store, Lincolnton, N. C.	57.0
3640	do	do	Madison Grocery Co., Madison, N. C.	96.0
3296	do	do	J. G. Messick, Winston-Salem, N. C.	31.5
3650	do	do	The Peoples Drug Store, Mt. Airy, N. C.	91.0
3470	do	D. M. Ferry & Co., Detroit, Mich.	Charlotte Drug Co., Charlotte, N. C.	64.5
3320	do	do	Cook & Harris, Concord, N. C.	70.0
3328	do	do	Dove-Bost Co., Concord, N. C.	79.0
3533	do	do	English Drug Co., Monroe, N. C.	70.0
3276	do	do	Farmers Trade House Co., Winston-Salem, N. C.	84.5
3574	do	do	L. G. Fox, Rockingham, N. C.	66.0
3543	do	do	Latham & Richardson, Monroe, N. C.	71.0
3309	do	do	J. W. McPherson & Co., Salisbury, N. C.	76.0
3660	do	do	Mt. Airy Feed Store, Mt. Airy, N. C.	71.0
3304	do	do	Owens Drug Store Co., Winston-Salem, N. C.	77.0
3569	do	do	Parson Drug Co., Wadesboro, N. C.	39.0
3465	do	do	Torrence Drug Co., Gastonia, N. C.	77.0
3538	do	do	Dr. S. J. Welsh & Son, Monroe, N. C.	86.0
3475	do	do	Woodall & Sheppard, Charlotte, N. C.	69.5
3579	do	Lake Shore Seed Co., Dunkirk, N. Y.	Eagle Pharmacy, Rockingham, N. C.	32.0
3549	do	do	Latham & Richardson, Monroe, N. C.	93.0

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TABLE XV.—RESULTS OF GERMINATION TESTS OF 16 KINDS OF VEGETABLE SEEDS, 807 SAMPLES IN ALL, COLLECTED BY INSPECTORS FROM JULY 15, 1913, TO JULY 15, 1914.—CONTINUED.

Laboratory Number	Kind of Seed	Wholesale Dealer	Retail Dealer	Per Cent of Germination
3752	MUSKMELON	Lake Shore Seed Co., Dunkirk, N. Y.	Lawnings Drug Store, Lincolnton, N. C.	76.0
3554	do	do	Earle Morrow Drug Store, Hamlet, N. C.	81.0
3528	do	D. Landreth Seed Co., Bristol, Pa.	English Drug Co., Monroe, N. C.	84.0
3333	do	do	Fetzer & Tucker, Reidsville, N. C.	96.0
4122	do	do	J. H. Rudisill & Co., Lincolnton, N. C.	94.0
4121	do	L. L. May & Co., St. Paul, Minn.	W. C. Asbury, Lincolnton, N. C.	70.5
3363	do	Jerome B. Rice Seed Co., Cambridge, N. Y.	J. F. Clarke, New Bern, N. C.	84.5
3905	do	do	A. S. Huske, Fayetteville, N. C.	94.5
4181	do	do	Leslie Drug Store, Morganton, N. C.	84.5
3988	do	do	C. Scott & Co., Greensboro, N. C.	93.5
3460	do	T. W. Wood & Sons, Richmond, Va.	Gaston Seed & Provision Co., Gastonia, N. C.	91.5
4124	do	do	do	62.0
4123	do	do	H. E. Kendall, Shelby, N. C.	61.5
3803	do	do	Jno. J. Thrower Co., Red Springs, N. C.	66.5
3889	OKRA	D. Landreth Seed Co., Bristol, Pa.	J. T. Fields, Laurinburg, N. C.	97.0
4012	ONIONS	Crosman Bros. Co., Rochester, N. Y.	J. J. Adams Sons & Co., Winston-Salem, N. C.	61.0
3920	do	D. M. Ferry & Co., Detroit, Mich.	Walter Credle & Co., Washington, N. C.	89.5
4105	do	Lake Shore Seed Co., Dunkirk, N. Y	W. C. Asbury, Lincolnton, N. C.	1.0
3954	PEAS	W. W. Barnard & Co., Chicago, Ill.	W. J. Kirkham & Co., Wilmington, N. C.	78.0

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3955	do	do	do	95.0
3587	do	do	T. N. Waters & Bro., Goldsboro, N. C.	84.0
4213	do	J. Bolgiano & Son, Baltimore, Md.	Mitchener Pharmacy, Edenton, N. C.	99.0
3486	do	Robert Buist Co., Philadelphia, Pa.	R. E. L. Cook, Tarboro, N. C.	51.5
4168	do	do	do	95.0
4169	do	do	do	95.0
4080	do	do	J. M. Lewis, Mt. Olive, N. C.	99.0
4079	do	do	B. F. Powell, Clinton, N. C.	96.0
3483	do	do	Saunders & Fowler, Williamston, N. C.	92.0
3711	do	do	Winston-Blanks Drug Co., Youngsville, N. C.	94.5
3726	do	W. Atlee Burpee & Co., Philadelphia, Pa.	Hunter Drug Co., Warrenton, N. C.	78.5
3957	do	Everett B. Clarke Seed Co., Milford, Conn.	Robert R. Bellamy, Wilmington, N. C.	92.0
3958	do	do	do	74.0
3959	do	do	do	99.5
4211	do	do	W. R. Brothers, Edenton, N. C.	94.0
3960	do	do	S. W. Willis, New Bern, N. C.	99.0
3716	do	Crosman Bros. Co., Rochester, N. Y.	E. T. Alford, Youngsville, N. C.	18.5
3777	do	do	Barnes Bros., Proctorville, N. C.	2.5
3851	do	do	E. L. Burns, Maxton, N. C.	81.5
3722	do	do	Wells Dilery, Roanoke Rapids, N. C.	59.0
3772	do	do	Taylor & Cowan, Jackson, N. C.	91.0
3710	do	Diggs & Beadles, Richmond, Va.	Aycock Drug Co., Louisburg, N. C.	69.0
3268	do	do	A. S. Huske, Fayetteville, N. C.	78.5
3898	do	do	do	99.5
3927	do	D. M. Ferry & Co., Detroit, Mich.	H. L. Arnold, Vanceboro, N. C.	90.0
3731	do	do	Burroughs Grocery Co., Warrenton, N. C.	56.5

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TABLE XV.—RESULTS OF GERMINATION TESTS OF 16 KINDS OF VEGETABLE SEEDS, 807 SAMPLES IN ALL, COLLECTED BY INSPECTORS FROM JULY 15, 1913, TO JULY 15, 1914.—CONTINUED.

Laboratory Number	Kind of Seed	Wholesale Dealer	Retail Dealer	Per Cent of Germination
3762	PEAS	D. M. Ferry & Co., Detroit, Mich.	Buthers Lumber Co., Boardman, N. C.	85.0
3232	do	do	A. J. Cook & Co., Fayetteville, N. C.	97.0
3921	do	do	Walter Credle & Co., Washington, N. C.	71.5
3443	do	do	B. B. Davenport, New Bern, N. C.	87.5
3737	do	do	S. J. Dilday, Ahoskie, N. C.	91.0
3593	do	do	Fitzgerald Drug Co., Rocky Mount, N. C.	85.0
3700	do	do	Franklin Grocery Co., Franklinton, N. C.	54.0
3666	do	do	Harrison & Hill Drug Co., Enfield, N. C.	70.5
3387	do	do	F. V. Johnston, Greenville, N. C.	86.5
3956	do	do	W. J. Kirkham & Co., Wilmington, N. C.	94.0
3417	do	do	J. B. Morton, Morehead City, N. C.	83.5
3437	do	do	Potter Bros., Beaufort, N. C.	54.5
3399	do	do	J. H. Roberson & Co., Robersonville, N. C.	36.5
3405	do	do	Theo. Roberson & Co., Williamston, N. C.	93.0
3256	do	do	Robinson Bros., Dunn, N. C.	74.5
3393	do	do	Robinson-Ruffin Co., Tarboro, N. C.	41.0
3244	do	do	W. M. Sanders, Smithfield, N. C.	42.5
3250	do	do	Selma Drug Co., Selma, N. C.	94.0
3743	do	do	J. T. Sisemore, Oxford, N. C.	87.0

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3238	do	do	W. F. Smith, Benson, N. C.	79.5
3411	do	do	Henry L. Spruill, Plymouth, N. C.	64.5
3455	do	do	D. W. Tart, Roseboro, N. C.	51.5
3449	do	do	G. T. Walton & Son, Jacksonville, N. C.	63.0
3381	do	do	Watson & Winslow, Hertford, N. C.	89.0
3422	do	do	E. K. Willis, Washington, N. C.	96.5
3672	do	do	J. D. Winstead & Son, Nashville, N. C.	92.5
3267	do	Lake Shore Seed Co., Dunkirk, N. Y.	J. B. Fields, Fayetteville, N. C.	47.5
3857	do	do	A. L. Jones, Maxton, N. C.	85.0
4039	do	do	Murray & Armstrong, Wallace, N. C.	81.0
4034	do	do	E. E. Rouse & Co., La Grange, N. C.	79.0
4051	do	do	Singestory Drug Co., Burgaw, N. C.	90.0
3368	do	do	Tom L. Smith, Plymouth, N. C.	88.5
3623	do	do	H. S. Southerland, Clinton, N. C.	52.5
3798	do	do	V. F. Tarlton, Wadesboro, N. C.	72.5
3340	do	do	D. W. Tart, Roseboro, N. C.	36.0
4045	do	do	W. D. Thomas & Co., Warsaw, N. C.	96.0
3428	do	D. Landreth Seed Co., Bristol, Pa.	Beaufort Drug Co., Beaufort, N. C.	43.0
3969	do	do	Spence & Hollowell, Elizabeth City, N. C.	98.0
4170	do	do	Thomas Bros., Henderson, N. C.	98.0
3789	do	Leonard Seed Co., Chicago, Ill.	Charlotte Drug Co., Charlotte, N. C.	29.0
3609	do	do	J. E. Hood & Co., Kinston, N. C.	82.0
4086	do	do	do	97.0
3269	do	do	A. S. Huske, Fayetteville, N. C.	92.0
3380	do	do	W. S. White & Co., Elizabeth City, N. C.	12.0
3374	do	L. L. May & Co., St. Paul, Minn.	Divers & Roper, Hertford, N. C.	74.5

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TABLE XV.—RESULTS OF GERMINATION TESTS OF 16 KINDS OF VEGETABLE SEEDS, 807 SAMPLES IN ALL, COLLECTED BY INSPECTORS FROM JULY 15, 1913, TO JULY 15, 1914.—CONTINUED.

Laboratory Number	Kind of Seed	Wholesale Dealer	Retail Dealer	Per Cent of Germination
3961	PEAS	J. B. Rice Seed Co., Cambridge, N. Y.	Blount Pharmacy, Washington, N. C.	97.5
3965	do	do	J. F. Clarke, New Bern, N. C.	100.0
3966	do	do	do	95.0
3967	do	do	F. S. Duffy, New Bern, N. C.	93.0
3963	do	do	J. H. Hardin, Wilmington, N. C.	98.0
3964	do	do	do	90.0
3261	do	do	A. S. Huske, Fayetteville, N. C.	98.0
3899	do	do	do	62.0
3534	do	do	Z. M. L. Jeffreys, Goldsboro, N. C.	82.5
4081	do	do	do	97.0
4082	do	do	do	90.0
3968	do	do	Spence & Hollowell, Elizabeth City, N. C.	64.0
3367	do	do	C. L. Spencer, New Bern, N. C.	69.0
4084	do	do	T. N. Waters & Bro., Goldsboro, N. C.	93.0
4085	do	do	do	94.0.
3962	do	do	W. S. White & Co., Elizabeth City, N. C.	95.5
4083	do	do	do	98.0
3970	do	Wood, Stubbs & Co., Louisville, Ky.	Brown Mercantile Co., Chadbourn, N. C.	92.0
4212	do	do	H. C. Joyner, Rocky Mount, N. C.	99.0

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4078	....do	....do	M. W. Pope, Mt. Olive, N. C.	96.0
3991	....do	T. W. Wood & Sons, Richmond, Va.	W. S. Allen, Reidsville, N. C.	84.0
3908	....do	....do	W. H. Bowen & Son, Belhaven, N. C.	56.0
4177	....do	....do	Bradsher's Pharmacy, Hendersonville, N. C.	94.0
3900	....do	....do	English Drug Co., Monroe, N. C.	87.0
3686	....do	....do	Furgerson Drug Co., Halifax, N. C.	50.0
4125	....do	....do	Gaston Seed & Provision Co., Gastonia, N. C.	61.0
3990	....do	....do	Mann Drug Co., High Point, N. C.	97.0
3493	....do	....do	J. A. Mitchener, Edenton, N. C.	42.5
3901	....do	....do	M. C. Rufty, Salisbury, N. C.	87.5
3617	....do	....do	J. D. Williams, Wilson, N. C.	95.0
4171	....do	....do	Wilson Drug Co., Wilson, N. C.	97.0
4058	RADISH	Robert Buist Co., Philadelphia, Pa.	E. B. Marston Drug Co., Kinston, N. C.	66.0
4132	....do	W. Atlee Burpee & Co., Philadelphia, Pa.	Hunter Drug Co., Warrenton, N. C.	85.0
3979	....do	Everett B. Clarke Seed Co., Milford, Conn.	R. R. Bellamy, Wilmington, N. C.	73.5
4029	....do	Crosman Bros. Co., Rochester, N. Y.	F. Barwick, La Grange, N. C.	64.5
4017	....do	....do	F. D. Scott & Son, Magnolia, N. C.	48.0
4154	....do	....do	Herbert Smith, Littleton, N. C.	28.0
4025	....do	....do	J. D. Williams, Wilson, N. C.	72.0
4021	....do	....do	W. A. Wilson, Dover, N. C.	62.5
4099	....do	D. M. Ferry & Co., Detroit, Mich.	Armour Bros., & Thompson, Davidson, N. C.	92.0
3926	....do	....do	H. L. Arnold, Vanceboro, N. C.	94.0
3881	....do	....do	N. A. Bell & Co., Dunn, N. C.	99.5
3986	....do	....do	Bruton & Co., Mt. Gilead, N. C.	83.5
3912	....do	....do	H. A. Chadwick, Pollocksville, N. C.	95.0
3919	....do	....do	Walter Credle & Co., Washington, N. C.	92.5

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Laboratory Number	Kind of Seed	Wholesale Dealer	Retail Dealer	Per Cent of Germination
3961	PEAS	J. B. Rice Seed Co., Cambridge, N. Y.	Blount Pharmacy, Washington, N. C.	97.5
3965	do	do	J. F. Clarke, New Bern, N. C.	100.0
3966	do	do	do	95.0
3967	do	do	F. S. Duffy, New Bern, N. C.	93.0
3963	do	do	J. H. Hardin, Wilmington, N. C.	98.0
3964	do	do	do	90.0
3281	do	do	A. S. Huske, Fayetteville, N. C.	98.0
3899	do	do	do	62.0
3594	do	do	Z. M. L. Jeffreys, Goldsboro, N. C.	82.5
4081	do	do	do	97.0
4082	do	do	do	90.0
3968	do	do	Spence & Hollowell, Elizabeth City, N. C.	64.0
3367	do	do	C. L. Spencer, New Bern, N. C.	69.0
4084	do	do	T. N. Waters & Bro., Goldsboro, N. C.	93.0
4085	do	do	do	94.0.
3962	do	do	W. S. White & Co., Elizabeth City, N. C.	95.5
4083	do	do	do	98.0
3970	do	Wood, Stubbs & Co., Louisville, Ky.	Brown Mercantile Co., Chadbourn, N. C.	92.0
4212	do	do	H. C. Joyner, Rocky Mount, N. C.	99.0

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4078	---do	---do	M. W. Pope, Mt. Olive, N. C.	96.0
3991	---do	T. W. Wood & Sons, Richmond, Va.	W. S. Allen, Reidsville, N. C.	84.0
3908	---do	---do	W. H. Bowen & Son, Belhaven, N. C.	56.0
4177	---do	---do	Bradsher's Pharmacy, Hendersonville, N. C.	94.0
3900	---do	---do	English Drug Co., Monroe, N. C.	87.0
3686	---do	---do	Furgerson Drug Co., Halifax, N. C.	50.0
4125	---do	---do	Gaston Seed & Provision Co., Gastonia, N. C.	61.0
3990	---do	---do	Mann Drug Co., High Point, N. C.	97.0
3493	---do	---do	J. A. Mitchener, Edenton, N. C.	42.5
3901	---do	---do	M. C. Rufty, Salisbury, N. C.	87.5
3617	---do	---do	J. D. Williams, Wilson, N. C.	95.0
4171	---do	---do	Wilson Drug Co., Wilson, N. C.	97.0
4058	RADISH	Robert Buist Co., Philadelphia, Pa.	E. B. Marston Drug Co., Kinston, N. C.	66.0
4132	---do	W. Atlee Burpee & Co., Philadelphia, Pa.	Hunter Drug Co., Warrenton, N. C.	85.0
3979	---do	Everett B. Clarke Seed Co., Milford, Conn.	R. R. Bellamy, Wilmington, N. C.	73.5
4029	---do	Crosman Bros. Co., Rochester, N. Y.	F. Barwick, La Grange, N. C.	64.5
4017	---do	---do	F. D. Scott & Son, Magnolia, N. C.	48.0
4154	---do	---do	Herbert Smith, Littleton, N. C.	28.0
4025	---do	---do	J. D. Williams, Wilson, N. C.	72.0
4021	---do	---do	W. A. Wilson, Dover, N. C.	62.5
4099	---do	D. M. Ferry & Co., Detroit, Mich.	Armour Bros., & Thompson, Davidson, N. C.	92.0
3926	---do	---do	H. L. Arnold, Vanceboro, N. C.	94.0
3881	---do	---do	N. A. Bell & Co., Dunn, N. C.	99.5
3986	---do	---do	Bruton & Co., Mt. Gilead, N. C.	83.5
3912	---do	---do	H. A. Chadwick, Pollocksville, N. C.	95.0
3919	---do	---do	Walter Credle & Co., Washington, N. C.	92.5

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TABLE XV.—RESULTS OF GERMINATION TESTS OF 16 KINDS OF VEGETABLE SEEDS, 807 SAMPLES IN ALL, COLLECTED BY INSPECTORS FROM JULY 15, 1913, TO JULY 15, 1914.—CONTINUED.

Laboratory Number	Kind of Seed	Wholesale Dealer	Retail Dealer	Per Cent of Germination
4139	RADISH	D. M. Ferry & Co., Detroit, Mich.	Hill Bros., Cofield, N. C.	93.0
4147	do	do	J. J. Madre & Bro., Windsor, N. C.	98.0
3916	do	do	W. J. Morgan, Oriental, N. C.	97.0
4143	do	do	W. P. Shaw, Jr. & Bro., Winton, N. C.	89.0
4055	do	do	T. L. & W. J. Turnage Co., Farmville, N. C.	93.5
4038	do	Lake Shore Seed Co., Dunkirk, N. Y.	Murray & Armstrong, Wallace, N. C.	92.0
4033	do	do	E. E. Rouse & Co., La Grange, N. C.	90.0
4009	do	do	Singestory Drug Co., Burgaw, N. C.	53.0
4044	do	do	W. D. Thomas & Co., Warsaw, N. C.	76.5
4201	do	D. Landreth Seed Co., Bristol, Pa.	Beaufort Drug Co., Beaufort, N. C.	72.5
3890	do	do	J. T. Fields, Laurinburg, N. C.	97.5
4135	do	L. L. May & Co., St. Paul, Minn.	Nash Supply Co., Nashville, N. C.	56.0
4191	SQUASH	Robert Buist Co., Philadelphia, Pa.	Davis Pharmacy, Marion, N. C.	75.0
3479	do	do	Reese & Alexander, Inc., Charlotte, N. C.	82.0
3280	do	do	P. A. Thompson, Winston-Salem, N. C.	80.0
3654	do	do	I. W. West Drug Co., Mt. Airy, N. C.	92.0
3290	do	Crosman Bros. & Co., Rochester, N. Y.	J. Emra Cox, Winston-Salem, N. C.	37.0
3284	do	do	Eford Bros., Winston-Salem, N. C.	73.0
3558	do	do	Fox & Lyon, Wadesboro, N. C.	84.0

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3644	....do	....do	Golden Rule Drug Store, Walnut Cove, N. C.	56.0
3755	....do	....do	Lawnings Drug Store, Lincolnton, N. C.	50.0
3639	....do	....do	Madison Grocery Co., Madison, N. C.	20.0
3295	....do	....do	J. G. Messick, Winston-Salem, N. C.	52.0
3649	....do	....do	The Peoples Drug Store, Mt. Airy, N. C.	70.0
3469	....do	D. M. Ferry & Co., Detroit, Mich.	Charlotte Drug Co., Charlotte, N. C.	54.0
3327	....do	....do	Dove-Bost Co., Concord, N. C.	60.0
3532	....do	....do	English Drug Co., Monroe, N. C.	60.0
3275	....do	....do	Farmers Trade House Co., Winston-Salem, N. C.	62.0
3573	....do	....do	L. G. Fox, Rockingham, N. C.	54.0
3542	....do	....do	Latham & Richardson, Monroe, N. C.	68.0
3308	....do	....do	J. W. McPherson & Co., Salisbury, N. C.	25.0
3654	....do	....do	Mt. Airy Feed Store, Mt. Airy, N. C.	46.0
3303	....do	....do	Owens Drug Co., Winston-Salem, N. C.	62.0
3569	....do	....do	Parson Drug Co., Wadesboro, N. C.	48.0
3464	....do	....do	Torrence Drug Co., Gastonia, N. C.	66.0
3537	....do	....do	Dr. S. J. Welsh & Son, Monroe, N. C.	42.5
3474	....do	....do	Woodall & Sheppard, Charlotte, N. C.	55.0
3578	....do	Lake Shore Seed Co., Dunkirk, N. Y.	Eagle Pharmacy, Rockingham, N. C.	74.0
3548	....do	....do	Latham & Richardson, Monroe, N. C.	26.0
3750	....do	....do	Lawnings Drug Store, Lincolnton, N. C.	56.0
3553	....do	....do	Earle Morrow Drug Store, Hamlet, N. C.	93.0
3527	....do	D. Landreth Seed Co., Bristol, Pa.	English Drug Co., Monroe, N. C.	60.0
3893	....do	....do	J. T. Fields, Laurinburg, N. C.	64.0
3689	....do	....do	Grant's Pharmacy, Asheville, N. C.	76.0
3300	....do	....do	F. W. O'Hanlon, Winston-Salem, N. C.	60.0

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TABLE XV.—RESULTS OF GERMINATION TESTS OF 16 KINDS OF VEGETABLE SEEDS, 807 SAMPLES IN ALL, COLLECTED BY INSPECTORS FROM JULY 15, 1913, TO JULY 15, 1914.—CONTINUED.

Laboratory Number	Kind of Seed	Wholesale Dealer	Retail Dealer	Per Cent of Germination
3317	SQUASH	T. W. Wood & Sons, Richmond, Va.	Davis Drug Co., Concord, N. C.	86.0
3459	....do	....do	Gaston Seed & Provision Co., Gastonia, N. C.	92.0
3314	....do	....do	Gibson Drug Co., Concord, N. C.	76.0
3980	TOMATOES	Robert Buist Co., Philadelphia, Pa.	R. R. Bellamy, Wilmington, N. C.	97.0
3882	....do	D. M. Ferry & Co., Detroit, Mich.	N. A. Bell & Co., Dunn, N. C.	80.0
3985	....do	....do	Bruton & Co., Mt. Gilead, N. C.	80.0
3876	....do	....do	Morrow Bros. & Heath Co., Albemarle, N. C.	81.0
3887	....do	....do	Selma Supply Co., Selma, N. C.	89.0
4104	....do	Lake Shore Seed Co., Dunkirk, N. Y.	W. C. Asbury, Lincolnton, N. C.	90.0
3892	....do	D. Landreth Seed Co., Bristol, Pa.	J. T. Fields, Laurinburg, N. C.	84.5
3989	....do	T. W. Wood & Sons, Richmond, Va.	J. F. Fulton, Greensboro, N. C.	91.0
3994	....do	....do	Mitchell & Barrow, Star, N. C.	92.5
3867	TURNIPS	Robert Buist Co., Philadelphia, Pa.	Doarfe Herring, Wilson, N. C.	53.5
3868	....do	....do	....do	32.0
4129	....do	W. Atlee Burpee & Co., Philadelphia, Pa.	Hunter Drug Co., Warrenton, N. C.	32.5
3712	....do	Crosman Bros. Co., Rochester, N. Y.	E. T. Alford, Youngsville, N. C.	85.0
3779	....do	....do	J. L. Bailey, Elm City, N. C.	78.5
3774	....do	....do	Barnes Bros., Proctorville, N. C.	83.5
4148	....do	....do	E. S. Barrett & Co., Jackson, N. C.	86.5

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4026	....do....	....do....	F. Barwick, La Grange, N. C.	71.0
3847	....do....	....do....	E. L. Burns, Maxton, N. C.	44.0
3718	....do....	....do....	Wells Dilery, Roanoke Rapids, N. C.	27.0
3844	....do....	....do....	Hart Drug Co., Norwood, N. C.	19.0
3834	....do....	....do....	Kennedy's Drug Store, Gastonia, N. C.	25.0
3810	....do....	....do....	Kiser & Mauney, Kings Mountain, N. C.	12.5
3766	....do....	....do....	Ruffin-High Co., Wilson, N. C.	86.0
4014	....do....	....do....	F. D. Scott & Son, Magnolia, N. C.	75.0
3839	....do....	....do....	Shankle, Snuggs Co., Albemarle, N. C.	3.0
4151	....do....	....do....	Herbert Smith, Littleton, N. C.	91.0
3769	....do....	....do....	Taylor & Cowan, Jackson, N. C.	76.0
3674	....do....	....do....	G. T. Whitehead & Co., Scotland Neck, N. C.	22.0
4022	....do....	....do....	J. D. Williams, Wilson, N. C.	86.0
4018	....do....	....do....	W. A. Wilson, Dover, N. C.	82.0
3923	....do....	D. M. Ferry & Co., Detroit, Mich.	H. L. Arnold, Vanceboro, N. C.	95.5
3806	....do....	....do....	Barnes-Finger Drug Co., Kings Mountain, N. C.	99.0
3877	....do....	....do....	N. A. Bell & Co., Dunn, N. C.	96.0
3727	....do....	....do....	Burroughs Grocery Co., Warrenton, N. C.	90.0
3758	....do....	....do....	Buthers Lumber Co., Boardman, N. C.	93.0
3909	....do....	....do....	H. A. Chadwick, Pollocksville, N. C.	96.5
3227	....do....	....do....	A. J. Cook & Co., Fayetteville, N. C.	82.5
3917	....do....	....do....	Walter Credle & Co., Washington, N. C.	90.5
3439	....do....	....do....	B. B. Davenport, New Bern, N. C.	81.5
3733	....do....	....do....	S. J. Dilday, Ahoskie, N. C.	99.5
3589	....do....	....do....	Fitzgerald Drug Co., Rocky Mount, N. C.	85.5
3696	....do....	....do....	Franklin Grocery Co., Franklinton, N. C.	97.0

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TABLE XV.—RESULTS OF GERMINATION TESTS OF 16 KINDS OF VEGETABLE SEEDS, 807 SAMPLES IN ALL, COLLECTED BY INSPECTORS FROM JULY 15, 1913, TO JULY 15, 1914.—CONTINUED.

Laboratory Number	Kind of Seed	Wholesale Dealer	Retail Dealer	Per Cent of Germination
3662	TURNIPS	D. M. Ferry & Co., Detroit, Mich	Harrison & Hill Drug Co., Enfield, N. C.	91.0
4136	do	do	Hill Bros., Cofield, N. C.	85.0
3389	do	do	F. V. Johnston, Greenville, N. C.	
4144	do	do	J. J. Madre & Bro., Windsor, N. C.	96.0
3913	do	do	W. J. Morgan, Oriental, N. C.	89.5
3421	do	do	J. B. Morton, Morehead City, N. C	83.5
3433	do	do	Potter Bros., Beaufort, N. C.	88.5
3401	do	do	J. H. Roberson & Co., Robersonville, N. C.	70.0
3407	do	do	Theo. Roberson & Co., Williamston, N. C.	87.5
3251	do	do	Robinson Bros., Dunn, N. C.	97.5
3395	do	do	Robinson-Ruffin Co., Tarboro, N. C.	73.0
3239	do	do	W. M. Sanders, Smithfield, N. C.	100.0
3245	do	do	Selma Drug Co., Selma, N. C.	75.5
3883	do	do	Selma Supply Co., Selma, N. C.	97.5
4140	do	do	W. P. Shaw, Jr. & Bro., Winton, N. C.	96.5
3739	do	do	J. T. Sizemore, Oxford, N. C.	100.0
3233	do	do	W. F. Smith, Benson, N. C.	95.0
3413	do	do	Henry L. Spruill, Plymouth, N. C.	83.0
3859	do	do	Standard Store Co., Aberdeen, N. C.	93.5

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3451	do	do	D. W. Tart, Roseboro, N. C.	90.5
4052	do	do	T. L. & W. J. Turnage Co., Farmville, N. C.	79.0
3445	do	do	G. T. Walton & Son, Jacksonville, N. C.	73.5
3384	do	do	Watson & Winslow, Hertford, N. C.	84.5
3425	do	do	E. K. Willis, Washington, N. C.	71.5
3668	do	do	J. D. Winstead & Son, Nashville, N. C.	78.0
3829	do	Lake Shore Seed Co., Dunkirk, N. Y.	Adams Drug Co., Gastonia, N. C.	43.0
4102	do	do	W. C. Asbury, Lincolnton, N. C.	94.0
3341	do	do	J. F. Clarke, New Bern, N. C.	39.5
3506	do	do	Divers & Roper, Hertford, N. C.	95.5
3262	do	do	J. B. Fields, Fayetteville, N. C.	56.5
3824	do	do	Hamlet Pharmacy, Hamlet, N. C.	9.0
3853	do	do	A. L. Jones, Maxton, N. C.	48.0
3545	do	do	Latham & Richardson, Monroe, N. C.	67.5
3630	do	do	Martin & Price Co., Mt. Olive, N. C.	91.0
3625	do	do	E. S. Mewborn, La Grange, N. C.	9.0
4036	do	do	Murray & Armstrong, Wallace, N. C.	94.5
4030	do	do	E. E. Rouse & Co., La Grange, N. C.	20.5
4047	do	do	Singestory Drug Co., Burgaw, N. C.	93.0
3371	do	do	T. L. Smith. Plymouth, N. C.	3.0
3619	do	do	H. S. Southerland, Clinton, N. C.	22.0
3501	do	do	J. L. Stashey, Greenville, N. C.	5.0
3794	do	do	V. F. Tarlton, Wadesboro, N. C.	17.5
3335	do	do	D. W. Tart, Roseboro, N. C.	8.5
4041	do	do	W. D. Thomas Co., Warsaw, N. C.	79.0
3496	do	do	W. S. White, Edenton, N. C.	25.5

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TABLE XV.—RESULTS OF GERMINATION TESTS OF 16 KINDS OF VEGETABLE SEEDS, 807 SAMPLES IN ALL, COLLECTED BY INSPECTORS FROM JULY 15, 1913, TO JULY 15, 1914.—CONTINUED.

Laboratory Number	Kind of Seed	Wholesale Dealer	Retail Dealer	Per Cent of Germination
3431	TURNIPS	D. Landreth Seed Co., Bristol, Pa.	Beaufort Drug Co., Beaufort, N. C.	91.5
4199	....do	....do	....do	76.0
3819	....do	....do	J. T. Fields, Laurinburg, N. C.	98.0
3516	....do	....do	Roberson, Cory & Co., Robersonville, N. C.	22.0
3864	....do	Leonard Seed Co., Chicago, Ill.	W. J. Kirkham & Co., Wilmington, N. C.	36.0
4094	....do	....do	J. M. Lewis, Mt. Olive, N. C.	97.5
3595	....do	L. L. May & Co., St. Paul, Minn.	Kyser's Drug Co., Rocky Mount, N. C.	90.5
4133	....do	....do	Nash Supply Co., Nashville, N. C.	98.0
3257	....do	Jerome B. Rice Seed Co., Cambridge, N. Y.	A. S. Huske, Fayetteville, N. C.	75.5
3987	....do	....do	C. Scott & Co., Greensboro, N. C.	90.5
3869	....do	T. W. Wood & Sons, Richmond, Va.	Hardy Drug Co., Washington, N. C.	90.0
3872	....do	....do	Raeford Hardware Co., Raeford, N. C.	83.5
3865	....do	....do	J. W. Sharp, Elm City, N. C.	86.5
3870	....do	....do	D. W. Tart, Roseboro, N. C.	84.5
3871	....do	....do	....do	30.5
3866	....do	....do	John L. Wooten Drug Co., Greenville, N. C.	74.5
3350	WATERMELONS	Robert Buist Co., Philadelphia, Pa.	R. R. Bellamy, Wilmington, N. C.	74.0
3977	....do	....do	....do	70.0
4005	....do	....do	S. F. Brown & Co., High Point, N. C.	90.5

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4118	....do	....do	Lowing & Costner, Lincolnton, N. C.	84.0
3604	....do	....do	Temple Drug Co., Kinston, N. C.	74.0
3605	....do	....do	....do	86.5
3979	....do	Everett B. Clarke Seed Co., Milford, Conn.	R. R. Bellamy, Wilmington, N. C.	80.0
3292	....do	Crosman Bros. Co., Rochester, N. Y.	J. Emra Cox, Winston-Salem, N. C.	54.0
3286	....do	....do	Eford Bros., Winston-Salem, N. C.	67.5
3560	....do	....do	Fox & Lyon, Wadesboro, N. C.	57.5
3646	....do	....do	Golden Rule Drug Co., Walnut Cove, N. C.	57.5
3757	....do	....do	Lawnings Drug Store, Lincolnton, N. C.	60.0
3641	....do	....do	Madison Grocery Co., Madison, N. C.	64.0
3297	....do	....do	J. G. Messick, Winston-Salem, N. C.	50.0
3651	....do	....do	The Peoples Drug Store, Mt. Airy, N. C.	56.0
3581	....do	Diggs & Beadles, Richmond, Va.	Deans & Moye Co., Goldsboro, N. C.	43.5
3324	....do	D. M. Ferry & Co., Detroit, Mich.	Cabarrus Drug Co., Concord, N. C.	72.0
3471	....do	....do	Charlotte Drug Co., Charlotte, N. C.	60.0
3321	....do	....do	Cook & Harris, Concord, N. C.	70.0
3329	....do	....do	Dove-Bost Co., Concord, N. C.	58.0
3534	....do	....do	English Drug Co., Monroe, N. C.	65.0
3277	....do	....do	Farmers Trade House Co., Winston-Salem, N. C.	80.0
3575	....do	....do	L. G. Fox, Rockingham, N. C.	62.5
3544	....do	....do	Latham & Richardson, Monroe, N. C.	67.5
3310	....do	....do	J. W. McPherson & Co., Salisbury, N. C.	46.0
3661	....do	....do	Mt. Airy Feed Store, Mt. Airy, N. C.	58.0
3305	....do	....do	Owens Drug Co., Winston-Salem, N. C.	82.5
3570	....do	....do	Parson Drug Co., Wadesboro, N. C.	55.0
3466	....do	....do	Torrence Drug Co., Gastonia, N. C.	52.5

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TABLE XV.—RESULTS OF GERMINATION TESTS OF 16 KINDS OF VEGETABLE SEEDS, 807 SAMPLES IN ALL, COLLECTED BY INSPECTORS FROM JULY 15, 1913, TO JULY 15, 1914.—CONTINUED.

Laboratory Number	Kind of Seed	Wholesale Dealer	Retail Dealer	Per Cent of Germination
3588	WATERMELONS	D. M. Ferry & Co., Detroit, Mich.	T. N. Waters & Bros., Goldsboro, N. C.	33.0
3539	do	do	Dr. S. J. Welsh & Son, Monroe, N. C.	70.0
3476	do	do	Woodall & Sheppard, Charlotte, N. C.	82.5
3580	do	Lake Shore Seed Co., Dunkirk, N. Y.	Eagle Pharmacy, Rockingham, N. C.	35.0
3550	do	do	Latham & Richardson, Monroe, N. C.	26.0
3753	do	do	Lawnings Drug Store, Lincolnton, N. C.	42.5
3555	do	do	Earle Morrow Drug Store, Hamlet, N. C.	92.5
3529	do	D. Landreth Seed Co., Bristol, Pa.	English Drug Co., Monroe, N. C.	77.5
3334	do	do	Fetzer & Tucker, Reidsville, N. C.	66.0
4116	do	do	J. H. Rudisill & Co., Lincolnton, N. C.	80.0
4117	do	do	do	71.5
4120	do	L. L. May & Co., St. Paul, Minn.	W. C. Asbury, Lincolnton, N. C.	69.0
4119	do	do	Clarence Clapp, Newton, N. C.	61.0
3904	do	J. B. Rice Seed Co., Cambridge, N. Y.	A. S. Huske, Fayetteville, N. C.	78.0
4093	do	do	Z. M. L. Jeffreys, Goldsboro, N. C.	94.0
4180	do	do	Leslie Drug Store, Morganton, N. C.	76.0
4178	do	T. W. Wood & Sons, Richmond, Va.	Bradsher's Pharmacy, Hendersonville, N. C.	89.5
4006	do	do	J. F. Fulton, Greensboro, N. C.	8.5
3461	do	do	Gaston Seed & Provision Co., Gastonia, N. C.	67.0

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4115	....do....	....do....	....do....	66.0
4113	....do....	....do....	H. E. Kendall, Shelby, N. C.	77.0
4114	....do....	....do....	....do....	78.0
4179	....do....	....do....	L. A. Kincaid, Morganton, N. C.	89.0
3903	....do....	....do....	M. C. Rufty, Salisbury, N. C.	78.5
3804	....do....	....do....	Jno. J. Steward Co., Red Springs, N. C.	40.0

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TABLE NO. 16.

SHOWING NUMBER AND AVERAGE PER CENT OF GERMINATION OF VEGETABLE SEED SAMPLES TESTED, ACCORDING TO WHOLESALE DEALERS.

Wholesale Dealer	Number of Samples Tested	Average Per Cent of Germination
W. W. Barnard & Co., Chicago, Ill.	9	87.00
J. Bolgiano & Son, Baltimore, Md.	2	51.00
Robert Buist Co., Philadelphia, Pa.	63	78.12
W. Atlee Burpee & Co., Philadelphia, Pa.	6	76.50
Everett B. Clarke Seed Co., Milford, Conn.	11	90.45
Crosman Bros. Co., Rochester, N. Y.	113	60.56
Diggs & Beadles, Richmond, Va.	5	60.70
D. M. Ferry & Co., Detroit, Mich.	233	77.64
Griffith & Turner, Baltimore, Md.	2	61.00
Lake Shore Seed Co., Dunkirk, N. Y.	95	64.04
D. Landreth Seed Co., Bristol, Pa.	54	80.21
Leonard Seed Co., Chicago, Ill.	27	72.19
L. L. May & Co., St. Paul, Minn.	18	68.36
J. B. Rice Seed Co., Cambridge, N. Y.	73	88.30
Wood, Stubbs & Co., Louisville, Ky.	12	95.75
T. W. Wood & Sons, Richmond, Va.	84	73.88

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SEED THOUGHTS FOR NORTH CAROLINA FARMERS.

1. Send samples of your seed to the North Carolina Seed Laboratory for examination and test before you buy. It will pay you; there is no charge.

2. The North Carolina Seed Laboratory is all yours. Use it for your own personal gain. Five cents will bring it right to your door, where it will solve your seed problems, free of charge.

3. Know what you are about to buy before you get it—you can't take seeds out of the ground after they have been sown.

4. Send your tobacco seeds to the North Carolina Seed Laboratory and have them recleaned—it will pay you, and we bear the expense.

5. Ask your seedsman why he refuses to guarantee the purity or the germination of his seed. If he will not guarantee his goods, send us a sample before you buy and find the reason—you may decide to let them remain HIS goods.

6. Send three or four tablespoonfuls of your grass, clover and other small seeds and about a cupful of corn, wheat, oats, peas and other seeds of this size when submitting a sample to the Laboratory for examination. Write your name and address plainly on the package and address it to the "North Carolina Seed Laboratory, Department of Agriculture, Raleigh, N. C." State whether you want us to examine it for PURITY or GERMINATION.

7. Do not buy or use "feed" oats for seed oats—they may have been heated in the bin and may fail to come up.

8. Seeds containing wild onions, wild mustard, couch grass, Canada thistle, wild oats, clover or alfalfa dodder, corn cockle, dog fennel, cheat, or wild carrot are unlawful for sale, for seeding purposes, in North Carolina.

9. Would you sell your neighbor seed too impure and dirty to sow on your own land? Then do not sell such seed to the seed dealer—your neighbor or some other man's might get them from the seedsman.

10. It is an agricultural sin, if not a moral crime, to sell clover seed containing dodder or seed wheat containing onions or cockle from your farm to a seedsman. Better sell such seed to your neighbor, who will then know whom to sue for damages.

11. All legitimate seed dealers in North Carolina have a license. Beware of the seed fakir who asks fabulous prices for ordinary seeds. Buy from honest seedsmen and leave the seed peddlers alone.

12. Watch the man who is willing to sell you seed without having a license. If he is willing to break the law for YOUR benefit, he might be willing to sell you inferior seeds for HIS benefit.

13. How many of your clover seed will come up from every hundred planted?

14. When your seed fail to come up you lose doubly.

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15. The North Carolina Seed Act fixes the standards of germination and purity for the following agricultural seeds. Purity means freedom from weed seeds and other foreign seeds; viability means germinating power or the ability to come up when planted.

Name of Seed	*Per Cent of Purity*	*Per Cent of Viable Seed*
Alfalfa	96	80
Barley	98	90
Blue grass, Canada	90	45
Blue Grass, Kentucky	80	45
Brome, awnless	90	75
Clover, alsike	96	75
Buckwheat	96	90
Clover, crimson	98	85
Clover, red	92	80
Clover, white	90	75
Corn, field	99	94
Corn, sweet	99	75
Fescue, meadow	95	85
Flax	96	89
Millet, Pearl	99	65
Millet, common	90	85
Millet, hog	90	85
Oats	98	90
Oat grass, tall	72	70
Orchard grass	70	70
Rape	99	90
Redtop	90	70
Rye	98	90
Rye grass, perennial	96	90
Rye grass, Italian	95	80
Sorghum	96	80
Sorghum for fodder	90	60
Timothy	96	85
Wheat	98	90

16. Wheat does not "turn to cheat," but seed wheat containing onions and cockle will cheat you out of a first-class crop.

17. Pestiferous weeds, like other troubles, are generally imported. See that you do not "import" weed seeds along with your other seeds from your seed dealer.

18. Dodder, wild carrot, cheat, wild onions, wild mustard, ox-eye daisy, bristly buckhorn, bracted plantain, Canada thistle, Russian thistle, nut grass, knawel, spiny pigweed, crab grass, sheep sorrel, smart weed, Spanish needles, dog fennel, and most other bad weeds are all imported into this country from Europe, or some other country, in impure seeds.

19. How long did it take you to rid your wheat fields and pastures of wild carrots and wild onions? These pests were imported from Europe in impure seeds.

20. Sow only good, clean seed.

21. Are your seed oats and seed wheat clean, or, are they full of dirt, cheat, and onions?

22. Any plant in your field different from the crop you are trying to grow is a weed.

23. Reclean your wheat before sowing—it will pay you.

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24. Treat your wheat and oats for smut by immersing the seed for thirty minutes in a solution of a pint of formalin in fifty gallons of water.

25. What is your method of ridding your fields of dodder, or the yellow "love vine?" This pest was also imported from Europe.

26. Those yellow spots of dodder in your clover fields are cancers that eat the vitals out of your clover crop. Quarantine this pest as you would smallpox.

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LEAF TOBACCO SALES FOR JUNE, 1914.

Pounds sold for producers, first hand	137,752
Pounds sold for dealers	16,128
Pounds resold for warehouse	18,018
Total	171,898

LEAF TOBACCO SALES FOR JULY, 1914.

Pounds sold for producers, first hand	124,913
Pounds sold for dealers	1,192
Pounds resold for warehouse	8,558
Total	134.663

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THE BULLETIN

OF THE

NORTH CAROLINA

DEPARTMENT OF AGRICULTURE

RALEIGH

Vol. 35, No. 11. SUPPLEMENT TO NOVEMBER, 1914 Whole No. 203

Pregressive Development of North Carolina Agriculture

WITH A BRIEF DISCUSSION OF

FOOD AND FEED PRODUCTS SHIPPED INTO THE STATE DURING YEAR 1913

(Bulletin No. 8, Vol. 33, Revised)

PUBLISHED MONTHLY AND SENT FREE TO CITIZENS ON APPLICATION.

Entered at the Postoffice at Raleigh, N. C., as second class matter, February 7, 1901, under Act of June 6, 1900.

EDWARDS & BROUGHTON PRINTING CO.
STATE PRINTERS

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LETTER OF TRANSMITTAL

Hon. W. A. Graham,

Commissioner of Agriculture,
Raleigh, N. C.

Sir:—I beg to submit herewith a manuscript, a revision of Bulletin No. 8, discussing, in a brief way, some of the different lines of progress of agriculture in North Carolina during the recent past. To those who desire a full discussion of the agricultural development of the State this Bulletin will be painfully brief; but we have only to point out that it would require a good-sized volume to do the subject justice, and that the time at our command and the space allotted to us would not permit a fuller discussion of the subject. We have been able, therefore, in this paper to call attention to only a few things among the many that cause North Carolina to stand out prominently above many other states.

In the last part of the paper is found a brief discussion of the amount of food and feed products shipped into the State during 1913. Most of the data for this part of the paper were obtained from the books of the different railway companies doing an interstate business in North Carolina.

I recommend the publication of this manuscript as a supplement from the Botany and Agronomy Division to the November Bulletin of this Department. Respectfully submitted,

J. L. Burgess,
Agronomist and Botanist.

Approved:
W. A. Graham,
Commissioner.

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Progressive Development of North Carolina Agriculture

WITH A BRIEF DISCUSSION OF

FOOD AND FEED PRODUCTS SHIPPED INTO NORTH CAROLINA DURING 1913

By J. L. BURGESS, Agronomist and Botanist.

STATUS OF THE FARMER.

Forty years ago North Carolina was a good state to be from; now it is one of the very best states in the Union to be in.

Agriculture in those days was frequently thought of as a hardship imposed upon the unfortunates who had to "toil" the soil for a living, and was, in many cases, looked upon as an occupation suitable for only those who were either financially or mentally incapable of pursuing a more popular calling.

But a change has come. Instead of being a drudgery and a despised menial occupation, as it once was, farming has, within the last two decades, been elevated to a position having the dignity of a profession, or a business, touching the intellect at every angle and taxing the mind to its utmost in grappling with the problems that daily arise on the farm for solution. Men everywhere are viewing the business of farming in a more favorable light. They are beginning to realize that there is no occupation more honorable, more necessary to the welfare of the State, or more deserving of the best efforts and energies in man, than that of tilling the soil. Indeed, all men are now insisting that it is the most noble of occupations, having been divinely instituted when man was first placed upon the earth, and Emerson has pointed out that "The first farmer was the first man, and all historic nobility rests on the possession and use of land."

THE FUNDAMENTAL CALLING.

It is a commonplace that agriculture is the foundation of all other occupations—mining, manufacture, commerce, etc. If we cease to plow, the miner will lay down his pick; factory wheels will stop; locomotives will stand cold and lifeless upon the tracks; abandoned ships will decay in the harbors; fishermen will cease to cast their nets; school children will come home to stay; church bells will cease to ring; and, very soon, savages will again roam over the face of the earth. An ample food supply, therefore, is essential to the highest moral, intellectual, and physical development of the human race. All wars, whether industrial or sanguinary are, in their last analysis, waged over an actual or fancied future scarcity of the necessaries of life. The mightiest factors in the

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world's civilization today, then, are the smoke-house and the granary; and, whether we will or not, the modern Atlas is "The Man with the Hoe." Good farming then will ever be the foundation on which all real progress in civilization must be made.

AGRICULTURAL ADVANTAGES IN NORTH CAROLINA.

Location.

The fondest hopes of the farmer may be realized right here in North Carolina. New England has little to offer the man who wants to farm. Forty years ago many farmers very wisely left the Old North State for Missouri, Kansas, Nebraska, Iowa, etc., and there homesteaded 160 acres of land that are now worth, in many cases, more than $32,000. A number of these men have sons who want to farm and can give them $4,000 to $6,000 with which to purchase land and equipment. But how much land can be purchased with $4,000 at $200 an acre. Few of them would be content with less than 80 acres, and to purchase this, without improvements, would require an outlay of $16,000. Add $4,000 for necessary improvements and he will have spent $20,000 for his 80-acre farm, perhaps, before he has reaped a single harvest or realized a penny on his investment. It is plain, therefore, that a young man of average means in the central west must be a renter if he farms at all. Farther west and northwest, the climate is too cold for any but the hardiest Scandinavians or north European immigrants. In the far west prices are, again, too high and competition too acute for an eastern man of average means. Farther south the climate is too hot and malaria is so prevalent that the health of a man from this latitude would, under average conditions, likely be threatened. Coming back to North Carolina, we find here all the advantages the farmer has anywhere else in the country, and the additional advantage of living in a state destined to become one of the leading manufacturing states of the Union.

Capital has not been slow to accept the invitation tacitly held out by our location with reference to other states, and our strategic position with reference to the future manufacturing development of the country. The 3,500,000 horse-power that but a few years ago was running to waste along the streams of the piedmont and mountain sections of the State is now being harnessed and utilized in the various manufacturing and other industrial enterprises. This immense power is just on the border of the cotton fields and among the forests and the mines. Our climates and soils are capable of producing more than enough to support the largest possible mill population that will ever be needed to manipulate the electric power generated by our streams. We have ample facilities for transporting raw materials and for handling an unlimited amount of finished products. No one is blind to our easy access to deep water on the coast, the Panama Canal, and thence to the Orient. Capital has seen its opportunity among us and has laid the foundation for its own protection and our development.

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MARKETS.

The greatest asset of any agricultural community is a good local market. There was a time when the North Carolina farmer looked in vain for a home market, but that time has passed. There was a time when no one seemed to want anything we had to sell, but economic conditions have so changed that nothing short of a national calamity is likely to reduce the present demand for the products of the North Carolina farm.

In respect to local markets, North Carolina is unexcelled and rarely equaled, by any state in the Union. We have no great metropolis like Baltimore or Washington to handle the bulk of our farm products, but we do have a large number of thriving cities.—Asheville, Gastonia, Charlotte, Winston, Salisbury, Greensboro, Monroe, Durham, Raleigh, Wilmington, Goldsboro, New Bern, Wilson, Rocky Mount, Tarboro, Kinston, Greenville Washington, Henderson, High Point, Elizabeth City, Fayetteville, and a number of others,—ranging in population from 3,000 to over 30,000 and scattered broadcast over the entire State. It would be practically impossible for a farmer to locate in North Carolina and not be within easy reach of some good home market. The day is fast approaching when it will be unnecessary for the North Carolina farmer to look outside the State for a market for his staple products. This statement can hardly be called visionary when we note the increase in number and kinds of manufactories within our borders and the large towns and consequent good markets which necessarily attend these manufacturing enterprises. New England is coming south with her mills and markets. These industries are constantly calling for more labor, and, since only white labor is wanted, a large percentage of the white farmers that were on farms twenty years ago are now working in the mills. The former producers of farm products have been transformed into consumers of farm products and producers of finished mill products. In other words, the mills have collected men, women, and children from large extents of territory and thus made good local markets for those of the rural population who preferred to stay on the farm.

North Carolina has a population of hundreds of thousands more than Kansas, Nebraska, South Carolina, Tennessee, Alabama, or Mississippi, and more than the states of Colorado, Nevada, Idaho, Montana, Wyoming, Vermont, and Delaware all combined, with a very large percentage of it in the different manufacturing towns. This should give great emphasis to the importance of our local markets for farm products. This fact is brought out clearly in the following table:

TABLE No 1—*Showing Population of North Carolina as Compared with Other States—1910.*

North Carolina	2,206,287
Tennessee	2,184,789
Alabama	2,138,093
Minnesota	2,075,708
Virginia	2,061,612
Mississippi	1,797,114
Kansas	1,690,949
Oklahoma	1,657,155
Louisiana	1,656,388

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Arkansas	1,574,449
South Carolina	1,515,400
Maryland	1,295,346
West Virginia	1,221,119
Nebraska	1,192,214
Washington	1,141,990
Connecticut	1,114,756
Colorado	799,024
Florida	752,619
Maine	742,371
Oregon	672,765
South Dakota	583,888
North Dakota	577,056
Rhode Island	542,610
New Hampshire	411,588
Montana	376,053
Utah	373,351
Vermont	355,956
District Columbia	331,069
New Mexico	327,301
Idaho	325,594
Arizona	204,354
Delaware	202,322
Wyoming	145,965

TRANSPORTATION.

Railroads.

No state in the South has better transportation facilities. Five great railroad systems are rushing through the State to reach deep water on the Atlantic coast, there to connect with steamers for the Panama Canal. Besides these, there are fifty-six other short lines and feeders that ramify the State like so many blood vessels in our great industrial system. Every farmer is thus put in easy reach of a good home market and is but a few hours from Charleston, Atlanta, Memphis, Chattanooga, St. Louis, Chicago, Pittsburg, Richmond, Washington, Baltimore Philadelphia, New York, and Boston.

Not only have we an excellent and rapidly growing system of railroad transportation, covering the entire State like a network, but in eastern North Carolina there is a veritable labyrinth of bays, sounds, canals, and navigable rivers on which there are thousands of boats, barges, and other vessels, handling farm produce between our own larger eastern cities and placing much of it on the markets of the cities to the north and south of us.

Country Roads.

In addition to our superb railroad and water transportation facilities there was launched some years ago a general movement for better country roads in North Carolina. That movement is still going on with daily increasing momentum. As a result there is hardly a county in the State which has not built, or is not contemplating the building of, good macadam or sand-clay roads leading from the county seat, or principal town of the county, into its remotest agricultural districts. These main lines of good roads have secondary or "belt" roads leading into them which are also graded and made good. In a word, both the railroad and dirt road facilities in North Carolina are, in many counties, simply un-

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surpassed by any State in the South and hardly equaled by any State in the Union. The farmers of North Carolina have been behind this good roads movement ever since its inception, thus showing the progressive spirit which pervades the agricultural classes of this State.

Telephones.

In addition to our superb transportation facilities, rural telephones are found everywhere, thus putting the farmer in immediate communication with the markets of his own locality and with those of distant localities at a cost ranging from seventy five cents to $1.00 per month.

EDUCATION.

In North Carolina, as in every other state, education—agricultural education—lies at the foundation of all good and successful farming. The ignorant man can no longer "farm if he can do nothing else." The needs of the increasing population and the demands of refined taste require that not only a greater acreage production, but that a finer quality of product be placed upon the market, and this can be done by intelligent farming only. Poor lands cannot make high average acre-yields and rich lands can not produce fine quality when manipulated by unskilled hands. Regardless of the yield per acre, there is no land so poor as that of the ignorant farmer, and none so rich as that of the man who knows how to manage his soils.

Gold mines and phosphate beds are but barren waste to the man who knows nothing of what is beneath the surface, while they are rich treasures to the man of trained mind and skilled hand. Less than forty years ago "Old Red Mountain" in Alabama was given "to boot" in a horse swap. Since then the vast deposits of iron ore stored away in those hills have built Birmingham and rolled millions upon millions of dollars into the coffers of the ironmasters. Why did not the original owner get a fortune out of these rich deposits of ore? And so it has been with the owners of many poor North Carolina farms. Hundreds of "old worn-out farms" have been sold or given to boot, as it were, by the erstwhile owners, who, failing to properly understand the local conditions and the possibilities of their acres, could not even support themselves and their families. The buyers, knowing the intrinsic value and nature of the soils, took the farms in hand for a nominal sum and have made a fortune where the original owners made a failure. The ones with their families are, perhaps, operatives in some cotton mill, while the others, with their families, are veritable lords of the land, using the cotton mill town as a market for their produce.

The locomotive existed in the mind of the inventor long before it stood upon the track. The statue always exists in the mind of the sculptor long before it emerges from the stone. So it is with the agricultural artist and the agricultural manufacturer. His ideal pork, beef, milch and draft animals, his maximum corn, wheat, and cotton crops exist in his mind months before they are found in the herd or in the field. The most fundamentally important things for farmers to possess, therefore, are not good land, good stock, good tools, good markets, and reliable labor, but correct ideals and proper vision. No castles were ever built on earth that were not first built in the air. These funda-

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mental ideals come only by a careful and diligent study of the factors controlling the development of any chosen vocation.

It means little to the farmer that farm products be high-priced if his profits are consumed in hauling them to market. It means little to the farmer to own land capable of producing 50 bushels of corn to the acre if his store of knowledge allows him to gather but 10 bushels from the acre. We must, therefore, have good roads, and good schools offering efficient agricultural instruction. But good roads and good schools alone will not make us a great agricultural state. These are but the tools with which we work. Nothing is further from the truth than the old adage that "knowledge is power." Knowledge is not power. It never has been. Power comes only as a result of an application of energy to knowledge. Every one has seen the walking encyclopedia whose brain is surcharged with facts but who never exerts any influence in his community. Every one has also seen the man of unbounded energy who didn't know what he wanted and had to have it—nervous, working, watching—always in a hurry and never getting anywhere; but when you find a man or woman possessed of great energy with an abundance of knowledge to direct it, you find a person who is a power in the land. There is not one volt more electro-motive force in the world today than there was 10,000 years ago, when it was manifested only in the thunderbolt and in the destructive shafts of lightning; but since the invention of the electric motor, even the cobbler in his shop uses the lightning as a beast of burden. The motor does not generate the power, neither does the electric current generate the power; but join the two together and every wheel in the industrial world may be propelled by the force. So it is with the farmer. When he has gained sufficient knowledge to give proper direction to his energy he will be proud to show us his fields of waving grain and his herds of fat cattle. Power, then, is ENERGIZED knowledge.

The North Carolina farmer has always had the energy, and within the last ten years he has, at a very rapid rate, been acquiring the knowledge. Twenty years ago the book farmer was looked upon as an idealist without practical ability. But conditions have changed. Since then not only have the farmers of North Carolina gone on record as favoring book farming, but have built schools and colleges for agricultural instruction, and our General Assemblies have passed laws putting agriculture into every public school in the State. At present the State Department of Agriculture, the United States Department of Agriculture, the A. and M. College, the State University, the State high schools, and practically every public school in the State are combining their efforts to dispel the mists from the eyes of the one man upon whose success the welfare of the entire State depends. Not only so, but there is a number of organizations among the farmers themselves that give promise of doing more to put farming in North Carolina on a sound business and scientific basis than any other agencies that have ever existed within our borders.

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RAW PRODUCTS.

Corn.

Corn grows in all parts of the State. It is our leading crop, and the yield is yearly increasing. It will be interesting to note that in 1913 the acre value of the corn crop of North Carolina was greater than that of either Georgia, Florida, Illinois, Missouri, North Dakota, South Dakota, Nebraska, Mississippi, Arkansas, Colorado, or New Mexico. Thus showing the special inducements in this State for the increased production of this crop.

Our genial climate, long growing season, and the rapidity with which the plant foods become available in the soils of the State throughout the entire year, all combine to make this crop one of especial importance both in point of yield and ease of production.

From 1870 to 1879 the average acre-yield of corn in the State was 14.7 bushels. This average persisted until 1909, when the average acre-yield of corn rose to 18.4 bushels, and in 1913 when it was 19.5 bushels per acre. The Division of Demonstration grew an average of over 44 bushels per acre on 4,800 acres of land in North Carolina in 1911. The amount of corn grown in the State in 1909 was 34,063,000 bushels and in 1910 nearly 57,139,000 bushels. The value of our corn crop in 1909 was $28,954,000; in 1910, $43,426,000; in 1911, $40,738,000; in 1912, $42,428,000; and in 1913, $48,648,000.

TABLE No. 2—*Showing Rank of North Carolina in Corn Production in 1913 as Compared with Other States.**

	Bushels.
North Carolina	55,282,000
Oklahoma	52,250,000
Virginia	51,480,000
Arkansas	47,025,000
Louisiana	41,800,000
South Carolina	38,512,000
Kansas	23,424,000
West Virginia	22,692,000
Maryland	22,110,000
New York	15,020,000
New Jersey	10,862,000
Florida	10,125,000
North Dakota	10,500,000
Colorado	6,300,000
Delaware	6,206,000
Connecticut	2,348,000
Massachusetts	1,944,000
California	1,815,000
Vermont	1,665,000
New Mexico	1,572,000
Washington	952,000
Montana	882,000
New Hampshire	814,000
Maine	608,000
Oregon	598,000
Wyoming	493,000
Arizona	476,000
Idaho	448,000
Rhode Island	402,000
Utah	340,000
Nevada	34,000

*Taken from United States Year Book for 1913.

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Wheat.

Wheat is rapidly gaining in importance as a staple crop in North Carolina. We have most excellent wheat lands in the State, but on account of the low prices of all farm products, until comparatively recently, the wheat crop has not been pushed cotton having largely taken its place even on our best wheat lands.

We can grow wheat and in large amounts. Every man remembers, when a school boy, to have had his especial attention called to California on account of its phenomenal yield of wheat, sometimes as high as 50 bushels to the acre having been reported. It is interesting to note that while the wheat crop of California has always been good, the average yield in that State has frequently fallen below the average yield in North Carolina. There have been as large yields of wheat obtained in this as, perhaps, almost any state in the Union—not yields from individual acres, but from whole farms. There is a large farm in Halifax County on which there was grown last year an average of 28½ bushels to the acre on a 140-acre field. In Johnston County a gentleman grew an average of 42 bushels to the acre on a 50-acre field, with individual acres yielding as high as 50 bushels. In Randolph County a gentleman grew an average of 27 bushels per acre on a 40-acre field. In Davidson County a farmer grew an average of over 30 bushels per acre on a 130-acre tract. But we need not multiply examples. Suffice it to say that these yields were gotten by the practice of common-sense methods on lands adapted by nature, or by preparation, to the growth of wheat. These yields may be duplicated by any farmer who has good heavy clay loam or silt loam soil and is willing to treat it properly.

The wheat crop in North Carolina in 1909 was 3,827,000 bushels; in 1910, 6,817,000 bushels; in 1911, 6,636,000 bushels; in 1912, 5,322,000 bushels; and, in 1913, 7,078,000 bushels.

TABLE No. 3.—*Showing Rank of North Carolina in Wheat Production in 1913 as Compared with Other States.**

	Bushels.
North Carolina	7,078,000
New York	6,800,000
Utah	6,420,000
California	4,200,000
Wisconsin	3,665,000
West Virginia	3,055,000
Wyoming	2,250,000
Georgia	1,708,000
Delaware	1,638,000
New Jersey	1,408,000
Arkansas	1,313,000
New Mexico	1,221,000
Nevada	1,081,000
South Carolina	972,000
Arizona	928,000
Alabama	374,000
Maine	76,000
Vermont	24,000
Mississippi	14,000

*Taken from United States Year Book for 1913.

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Oats.

The oat crop in North Carolina in 1909 was 3,234,000 bushels; in 1910, 3,458,000 bushels; in 1911, 3,614,000 bushels; in 1912, 3,794,000 bushels; and in 1913, 4,485,000 bushels. The value of the oat crop in $2,352,000; and, in 1913, $2,736,000.
$2,352,000, and, in 1913, $2,736,000.

TABLE No. 4.—*Showing Rank of North Carolina in Oats Production in 1913 as Compared with Other States.**

	Bushels.
North Carolina	4,485,000
Virginia	4,192,000
Utah	4,140,000
Kentucky	3,168,000
Vermont	3,082,000
Mississippi	2,800,000
West Virginia	2,760,000
New Jersey	2,030,000
New Mexico	1,500,000
Maryland	1,260,000
Louisiana	990,000
Florida	900,000
Nevada	473,000
New Hampshire	420,000
Massachusetts	315,000
Connecticut	308,000
Arizona	301,000
Delaware	122,000
Rhode Island	52,000

Cotton.

Notwithstanding we are on the northern limit of the cotton belt, a large amount of this staple crop is produced every year—indeed we have a few counties that are unexcelled in cotton production. Last year it was the boast of Robeson, one of the largest counties in the State, that it produced a bale of cotton to every man, woman, and child in it.

The cotton crop is at present the most valuable single crop in the State, ranging in value between $50,000,000 and $60,000,000 per annum.

The total cotton crop for North Carolina in 1906 was 579,326 bales. Since then we have gradually increased the total yield until in 1911 we produced the maximum crop in the history of the State, amounting to 1,075,826 bales. It is true that in 1911 we had greater acreage than in any other year since 1906, but the yield per acre, which should always be the basis of calculation in comparing farm crops, was considerably more than that of any other recognized cotton-growing State in the Union. We, are, therefore, not only increasing the total yield of this product, but we seem to be doing better farming than we have done in past years.

*Taken from United States Year Book for 1913.

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TABLE No 5.—*Showing Average Acre Yield of Cotton in North Carolina in 1913 as Compared with Other States.**

	Pounds.
North Carolina	239
South Carolina	235
Tennessee	210
Georgia	208
Arkansas	205
Mississippi	204
Alabama	190
Texas	150
Florida	150
Oklahoma	132

Live Stock.

The number of live stock in North Carolina could be greatly increased to the advantage of every farmer in the State. We have not nearly as much live stock as our farms require, and the quality is very inferior to that which could be desired. Nevertheless, within the last ten years the percentage of increase of live stock in North Carolina has been greater than that of any of the thirty-eight states shown in the following table. A glance at the table will show that the percentage of increase of live stock in North Carolina in the last ten years has been more than double that of New York, Iowa, Colorado, Pennsylvania, Kansas, Texas, and West Virginia, and considerably more than that of Missouria, Michigan, Wisconsin and Illinois.

In 1913 North Carolina had 312,000 milch cows and 92,000 other cattle. There were 181,000 sheep on the farms and 1,335,000 hogs.

TABLE No. 6.—*Showing Percentage Increase in Number of Live Stock in North Carolina as Compared with Other States—1900-1910.**

North Carolina	108.1
Arkansas	97.6
South Dakota	95.2
California	89.6
Florida	84.4
Tennessee	82.0
Alabama	81.7
Minnesota	81.5
Virginia	78.2
Missouri	78.0
Mississippi	76.4
Oregon	75.3
Michigan	74.3
Arizona	67.6
Wyoming	67.6
Delaware	64.6
Wisconsin	64.2
Montana	64.2
Illinois	59.4
Kentucky	59.3
Indiana	58.7
Oklahoma	58.4
Nevada	57.9
Ohio	56.7
Maryland	56.2

* Taken from United States Year Book for 1913.

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Louisiana	54.8
Nebraska	52.9
Maine	47.1
New York	45.8
West Virginia	41.6
Iowa	40.9
Colorado	40.5
New Jersey	39.6
Pennsylvania	38.1
New Mexico	37.1
Utah	34.0
Kansas	32.8
Texas	32.5
Massachusetts	31.3
Connecticut	29.6
Vermont	26.9
Rhode Island	26.3
District of Columbia	22.0
New Hampshire	12.8

MANUFACTURED PRODUCTS.

In 1904 the State of North Carolina had 3,272 manufacturing establishments, which gave employment to an average of 93,142 persons during the year and paid $25,170,000 in salaries and wages. In 1909 there were 49,931 manufacturing establishments, giving employment to 133,453 persons and paying out during the year $41,259,000 in salaries and wages. This shows the rate at which manufacturing enterprises are increasing in this State. The value of the total manufactured products of the State in 1910 was $216,656,000, which was over $13,500,000 more than Georgia, our closest competitor in the South. The following table will show at a glance how North Carolina ranks as a manufacturing state. While it is not the first in value of manufactured products it is ahead of a great many others.

TABLE No. 7.—*Showing Rank of North Carolina in Manufactured Products as Compared with Other States in 1910.*

North Carolina	$216,656,000
Georgia	202,863,000
Nebraska	199,019,000
Tennessee	180,217,000
Maine	176,029,000
New Hampshire	164,581,000
West Virginia	161,950,000
Alabama	145,962,000
Colorado	130,044,000
South Carolina	113,236,000
Oregon	93,005,000
Mississippi	80,555,000
Arkansas	74,916,000
Montana	73,272,000
Florida	72,890,000
Vermont	68,310,000
Utah	61,989,000
Oklahoma	53,682,000
Delaware	52,840,000
Arizona	50,267,000
District of Columbia	25,289,000
Idaho	22,400,000
North Dakota	19,138,000

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South Dakota	17,870,000
Nevada	11,887,000
New Mexico	7,898,000
Wyoming	6,249,000

No state can turn out such an enormous amount of manufactured products without taxing to the utmost its agricultural resources. Cotton and other raw materials for manufacture, and for food supplies for men and necessary teams, must be produced on the farms, or imported from other states.

While the North Carolina farmer has made long and rapid strides in every line of agricultural development in the recent past, he is going to make even greater progress in the near future. The inducements for greater efforts are here. Our home markets are calling for more than we can produce with our present methods, and our neighboring markets are yet not fully supplied.

By the introduction of improved implements and the most approved methods of tillage, fertilization, etc., the present annual crop yields can be more than doubled, and there is little doubt that they will be more than doubled in the near future. But even then, it is not likely that our present farming population can nearly supply the demands made on them for food and feed products. As our crop yields increase, the demand for the additional output will likewise increase. It would seem, therefore, that a very material addition to our farming population is imperative.

We have 22,439,129 acres of land in farms in North Carolina. Of this amount of land, only 8,813,056 acres are improved. This leaves 13,626,073 acres of unimproved land in farms. It is evident that this vast territory of nonproductive land should be brought under cultivation and made to contribute its share to the wealth of the State, and to do this would require about twice our present farming population.

As pointed out above, our markets are calling for more than we are producing, and, as a consequence, millions upon millions of dollars worth of food and feed products are yearly being shipped into the State from outside sources.

FOOD PRODUCTS SHIPPED INTO THE STATE OF NORTH CAROLINA DURING 1913.

Three years ago the Division of Botany and Agronomy was directed to ascertain, as far as possible, the amount of food and feed products shipped into the State during 1911. The results of that investigation showed that around $39,000,000 worth of these products were shipped into North Carolina during that year. This year, 1914, the Commissioner of Agriculture again directed this Division to make a similar investigation for the same purpose. Using the same method of investigation as we used before, we addressed a letter to each of the railroad companies operating inter-state lines of railroad, asking them to furnish us with such data as might be available to show the amount of various food and feed products shipped into the State over their lines during 1913.

We are pleased to state that all of the leading lines of railroads responded promptly to this request, except one, and gave us figures

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taken directly from their books. The Seaboard Air Line and four short lines of railroad failed to give us the data requested, and we were forced to estimate the products shipped in over these short lines in 1913 as the same as that shipped in over them during 1911. Since the Coast line and the Seaboard Air Line traverse pretty much the same territory we felt justified in estimating the shipments over these two lines as being about equal. This enables us to present fairly reliable data showing the amount of food and feed products shipped into the State over the different lines of railroads during 1913.

Southern Railway.

During the year 1913 the Southern Railway shipped into the territory traversed by its lines 3,347,064 bushels of corn; 142,065 bushels of wheat; 59,010 barrels of apples; 5,530,000 pounds of cured meat; 15,392,000 pounds of dressed beef; 2,880 cases of canned goods; 15,825,000 pounds of vegetables; 16,512 tons of hay, and 779 tons of feedstuffs.

Norfolk and Western Railroad.

The Norfolk and Western Railroad shipped into the territory traversed by its lines during 1913, 2,712,292 bushels of corn; 435,078 bushels of wheat; 263,567 bushels of oats; 8,607 barrels of apples; 69,188 pounds of dried fruit; 1,529,088 pounds of cured meat; 895,886 pounds of fresh pork; 21 barrels of barreled pork; 1,157,792 pounds of dressed beef; 2,222 pounds of corned beef; 2,955 pounds of butter; 113,631 pounds of cheese; 24,571 cases of canned goods; 47,124 gallons of syrup; 2,621 pounds of honey; 2,783 tons of hay; 10,578 tons of feedstuffs, and 2,650 dozen of eggs.

Winston-Salem Southbound.

During the year 1913 this branch of the Norfolk and Western shipped into middle North Carolina 11,389 bushels of corn; 20,830 bushels of wheat; 53,860 bushels of oats; 611 barrels of apples; 16,065 pounds of dried fruit; 109,051 pounds of cured meat; 20,000 pounds of fresh pork; 2,000 pounds of corned beef; 1,350 pounds of butter; 8,050 pounds of cheese; 6,278 cases of canned goods; 14,800 gallons of syrup; 862 pounds of honey; 1,182 tons of hay; 866 tons of feedstuff, and 264 dozen eggs.

Atlantic Coast Line.

This road shipped into Eastern North Carolina during the year 1913 1,773,936 bushels of corn; 1,649,850 bushels of wheat in the form of flour, and 29,570 tons of hay.

Norfolk Southern Railway.

This road shipped into Eastern North Carolina during 1913 726,056 bushels of corn; 1,070,541 bushels of wheat in the form of flour; 47,023 tons of mill feed; 17,857 tons of hay; 940,000 pounds of dressed meat; 13,078,000 pounds of other packing-house products and 2,762,000 pounds of other animal products as leather, hides, butter, eggs, etc.

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Seaboard Air Line Railway.

The estimated amounts of products shipped into that part of the State traversed by this system during 1913 were 1,773,936 bushels of corn; 1,649,850 bushels of wheat and 29,570 tons of hay.

Mount Airy and Eastern Railway.

This road shipped into the State from the North and West during 1913, 12 bushels of corn; 242 barrels of apples; 2,300 pounds of dried fruit; 53 cases of canned goods; 150 pounds of pork, and 99 bushels of potatoes.

East Tennessee and Western North Carolina Railroad.

This railroad shipped into the mountain section of North Carolina during 1913 25,952 bushels of corn; 115 bushels of wheat; 13,576 bushels of oats; 10,466 barrels of flour; 60 barrels of apples; 120 pounds of dried fruit; 232,231 pounds of cured meat; 1,847 pounds of fresh pork; 1,149 pounds of dressed beef; 830 pounds of canned beef; 160 pounds of butter; 8,373 pounds of cheese; 3,808 cases of canned goods; 38 gallons of syrup; 3,659 pounds of honey; 140 pounds of vegetables; 241 tons of hay, and 802 tons of feedstuff. Estimated for 1913.

Danville and Western Railway.

It is estimated that this road shipped into Rockingham County during 1913 17,835 bushels of corn; 30,104 bushels of wheat; 7,161 bushels of oats; 111,138 barrels of flour; 1,348 barrels of apples; 6,050 pounds of dried fruit; 133,528 pounds of cured meat; 4,600 pounds of fresh pork; 2,000 barrels of barreled pork; 3,580 pounds of corned beef; 872 pounds of butter; 157,666 pounds of cheese; 6,591 cases of canned goods; 9,500 gallons of syrup; 1,638 pounds of honey; 96,000 pounds of vegetables and 2,240 tons of hay and 1,045 tons of feedstuff.

Tallulah Falls Railway.

It is estimated that this short line of railroad shipped into Western North Carolina during the period under discussion 7,643 bushels of corn; 3,397 barrels of flour; 492,000 pounds of cured meat; 26 tons of hay, and 85 tons of feedstuff.

Carolina, Clinchfield and Ohio Railway.

It is estimated that the Carolina, Clinchfield and Ohio Railway shipped into Northwestern North Carolina during 1913 50,526 bushels of corn; 173 bushels of wheat; 9,211 bushels of oats; 12,600 barrels of flour; 52 barrels of apples; 182,925 pounds of cured meat; 3,606 pounds of fresh pork; 15 barrels of barreled pork; 450 pounds of dressed beef; 30,051 pounds of corned beef; 215 pounds of butter; 7,043 pounds of cheese; 14,718 cases of canned goods; 1,908 pounds of honey; 9,066 tons of hay, and 4,939 tons of feedstuff.

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SHOWING AMOUNT OF FOOD AND FEED PRODUCTS SHIPPED INTO NORTH CAROLINA DURING 1913.

Railroad	Corn (Bushels)	Wheat (Bushels)	Oats (Bushels)	Apples (Barrels)	Dried Fruit (Pounds)	Dried Meat (Pounds)
Southern	3,347,064	142,065		59,010		5,530,000
Norfolk & Western	271,292	435,078	263,567	8,607	69,788	1,529,088
Norfolk Southern	726,056	1,070,541				
Atlantic Coast Line	1,773,936	1,649,850				
Seaboard Air Line	1,773,936	1,649,850				
Car. Clinchfield & Ohio*	50,526	63,173	9,211	52		182,925
Winston-Salem Southbound	11,389	20,830	53,860	611	16,065	109,051
E. Tenn. & W. N. C.	25,952	52,445	13,576	60	120	232,231
Danville & Western*	17,835	585,830	7,161	1,348	6,050	133,528
Mount Airy & Eastern	12			242	2,300	
Talulah Falls Ry.*	7,643	16,985				492,000
Totals	8,005,641	5,686,647	347,375	69,930	94,323	8,208,823
	@ 80c	@ $1.00	@ 50c	@ $5.00	@ 10c	@ 12½ c
	$6,404,672.80	$5,686,647.00	$173,687.50	$349,650.00	$9,432.30	$1,027,102.87

*Estimated to be same as 1911.

Railroad	Fresh Pork (Pounds)	Barreled Pork (Barrels)	Dressed Beef (Pounds)	Corned Beef (Pounds)	Butter (Pounds)
Southern			15,392,000		
Norfolk & Western	895,886	21	1,157,792	20,222	2,955
Norfolk Southern			940,000		
Atlantic Coast Line					
Seaboard Air Line					
Carolina, Clinchfield & Ohio*	3,606	15	450	30,051	215
Winston-Salem South Bound	20,000			2,000	1,350
E. Tenn. & W. N. C.*	1,847		1,149	830	160
Danville & Western*	4,600	2,000		3,580	872
Mt. Airy & Eastern	150				
Tallulah Falls Ry.*					
Totals	926,089	2,036	17,491,391	56,683	5,552
	@ 10c	@ $25	@ 9c	@ 12½c	@ 20c
	$92,608.90	$50,900.00	$1,574,225.19	$7,085.25	$1,110.40

*Estimated to be same as 1911.

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Railroads	Cheese (Pounds)	Canned Goods (Cases)	Syrup (Gallons)	Honey (Pounds)	Vegetables (Pounds)	Hay (Tons)
Southern		2,880			15,825	16,512
Norfolk & Western	113,631	24,571	47,124	2,621	15,825	2,783
Norfolk Southern						17,857
Atlantic Coast Line						29,570
Seaboard Air Line						29,570
Car., Clinchfield & Ohio*	7,043	14,718		1,908		9,066
Winston-Salem Southbound	8,050	6,278	14,800	862		1,182
E. Tenn. & W. N. C.*	8,373	3,808	38	3,659	140	241
Danville & Western*	157,666	6,591	9,500	1,638	96,000	2,240
Mt. Airy & Eastern		53			4,954	
Talulah Falls Ry.*						26
Totals	294,763	58,899	71,462	10,688	132,740	108,047
	@ 12½c	@ $2.50	@ 40c	@ 10c	@ 5c	@ $20
	$36,845.37	$147,247.50	$28,584.80	$1,068.80	$6,637.00	$2,160,940.00

*Estimated to be same as 1911.

Railroad	Feed Stuffs (Tons	Miscellaneous Packinghouse Products (Pounds)
Southern	779	
Norfolk & Western	10,578	
Norfolk Southern	47,023	13,078,000
Atlantic Coast Line		
Seaboard Air Line		
Carolina, Clinchfield & Ohio*	4,839	
Winston-Salem Southbound	866	
East Tennessee & Western North Carolina*	802	
Danville & Western*	1,045	
Mt. Airy & Eastern		
Talulah Falls Ry.*	85	
Totals	66,017	13,078,000
	@ $25	@ 10c
	$1,650,425.00	$1,307,800.00

*Estimated to be same as 1911.

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TABLE No. 9.—*Showing Comparative Values of Food and Feed Products Shipped Into North Carolina During 1911 and 1913.*

	1911.	*1913.*
Corn @ 80c. bushel	$4,346,420.80	$6,404,672.80
Wheat @ $1.00 a bushel	4,378,316.00	5,686,647.00
Oats @ 50c. a bushel	119,966.00	173,687.00
Apples @ $5.00 a barrel	357,105.00	349,650.00
Dried fruit @ 10c. a pound	19,420.30	9,432.30
Cured meat @ 12½c. a pound	6,666,429.62	1,027,102.87
Fresh pork @ 10c. a pound	37,664.30	92,608.90
Barreled pork @ $25 a barrel of 200 pounds	55,875.00	50,900.00
Dressed Beef @ 12½c. a pound	12,937.00	7,085.25
Miscellaneous packing house products @ 10c.	.....	1,307,800.00
Butter @ 20c. a pound	875.20	1,110.40
Cheese @ 12½c. a pound	39,057.37	36,845.37
Canned goods @ $2.50 a case	116,257.50	147,247.50
Syrup @ 40c. a gallon	21,110.80	28,584.80
Honey @ 10c. a pound	789.50	1,068.80
Vegetables @ 5c. a pound	3,516,716.45	6,637.00
Hay @ $20 a ton	15,607,820.00	2,160,940.00
Feed stuffs—bran, shorts etc., @ $25 a ton	2,225,625.00	1,650,425.00
Total	$39,640,885.55	$20,716,671.68
Balance in favor of 1913		**$19,124,213.87**

The above figures, most of which were taken direct from the books of the different railroad companies doing an inter-state business, seem to be the closest approximation possible to the actual facts, and while it is not claimed that these figures are within even a million dollars of correct, due to the impracticability of getting any but the leading items of import, they still show that the state has decreased its imports enormously within the last three or four years, and is thus waking to the possibility and necessity of producing its own food supplies. Our people are beginning to live at home.

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THE BULLETIN

OF THE

NORTH CAROLINA

DEPARTMENT OF AGRICULTURE

RALEIGH

Vol. 36, No. 1. JANUARY, 1915 Whole No. 205

ANNUAL REPORT

OF

FARMERS' INSTITUTES

PUBLISHED MONTHLY AND SENT FREE TO CITIZENS ON APPLICATION.

Entered at the Postoffice at Raleigh, N. C., as second class matter, February 7, 1901, under Act of June 6, 1900.

EDWARDS & BROUGHTON PRINTING CO.
STATE PRINTERS

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LETTER OF TRANSMITTAL

RALEIGH, N. C., December 8, 1914.

HON. W. A. GRAHAM,
Commissioner of Agriculture,
Raleigh, N. C.

SIR:—Herewith find my annual report of Farmers' and Women's Institutes for the current year, which I recommend for the January, 1915, BULLETIN.

Respectfully,
T. B. PARKER,
Directors of Farmers' Institutes.

Approved for printing:
W. A. GRAHAM,
Commissioner.

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REPORT OF FARMERS' INSTITUTES, 1914

By T. B. Parker, Director of Farmers' Institutes.

From December 1, 1913, to November 30, 1914, the following number of institutes were held in the State under the auspices of the State Department of Agriculture: 250 regular institutes for men, 9 special or Orchard Demonstration Institutes, and 2 institutes for negroes, with a total attendance of 35,632. There were held at the same time and places 240 regular institutes for women with an attendance of 33,227, with an additional attendance of 2,960 at local institutes, making the total attendance at women's institutes 36,187, or a grand total for men and women of 71,819, against 57,805 for last year.

The demand for institutes was much greater this year than in any previous year.

FARMERS' INSTITUTES, 1914.

County	Date	Place	Lecturers
Alamance	Aug. 17	Elon College	Hendricks, Curtis, Garren.
	Aug. 18	Maywood	Hendricks, Curtis, Garren.
	Aug. 19	Spring Graded School	Hendricks, Curtis, Garren.
	Aug. 20	Hawfield Graded School	Hendricks, Curtis, Garren.
Alexander	July 31	Taylorsville	Kerr, French, Young.
Alleghany	Sept. 14	Glade Valley	Sherman, Hudson, Reed.
	Sept. 15	Sparta	Sherman, Hudson, Reed.
	Sept. 16	Whitehead	Sherman, Hudson, Reed.
Anson	Aug. 8	McFarlan	Chrisman, Young, Parker, T. F.
	Aug. 11	Polkton	Chrisman, Young, Parker, T. F.
	Aug. 12	Wadesboro	Chrisman, Young, Parker, T. F.
	Aug. 20	Ansonville	Chrisman, Sloan, Kerr.
Ashe	Sept. 17	Scottville	Sherman, Hudson, Reed.
	Sept. 18	Grassy Creek	Sherman, Hudson, Reed.
	Sept. 19	Jefferson	Sherman, Hudson, Reed.
Avery	Sept. 22	Banners Elk	Sherman, Hudson, Reed.
Beaufort	Jan. 19	Bath	Sherman, Latham, Sloan.
	Jan. 20	Aurora	Sherman, Latham, Sloan.
	Jan. 21	Washington	Sherman, Latham, Sloan.
	Jan. 24	Pantego	Sherman, Latham, Sloan.
	Oct. 27-28	Bath	Latham, Sloan.
Bertie	Feb. 16	Mars Hill	Sherman, Rives.
	Feb. 17	Windsor	Sherman, Rives.
Bladen	Jan. 22	Tarheel	Garren, Hill, Robertson.
Brunswick	Feb. 3	Winnabow	Garren, Hill, Robertson.
	Feb. 4	Mt. Pisgah	Garren, Hill, Robertson.
	Feb. 6	Ash	Garren, Hill, Robertson.
Buncombe	Sept. 1	Swannanoa	Garren, Hill.
	Sept. 30	Sand Hill	Parker, T. B., Cheshire, Garren.
Burke	Aug. 5	Hildebran	Kerr, French, Young.
	Aug. 6	Hickory Grove S. H.	Kerr, French, Young.
Cabarrus	Aug. 11	Rimer	Hendricks, Curtis, Owen.
	Aug. 12	Concord	Hendricks, Curtis, Owen, Sloan.
Caldwell	Aug. 3	Collettsville	Kerr, French, Young.
	Aug. 4	Hudson	Kerr, French, Young.

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FARMERS' INSTITUTES, 1914—Continued.

County	Date	Place	Lecturers
Camden	Jan. 31	Camden C. H.	Sherman, Burgess, Sloan.
Carteret	Feb. 10	Newport	Kerr, Newell, Sloan.
Caswell	July 29	Leasburg	Scott, Parker, T. B., Cunningham.
	July 30	Semora	Scott, Parker, T. B., Cunningham.
Catawba	Aug. 14	Cloninger's Farm	Robinson, Shuford, Combs.
	Aug. 15	Rockett, S. H.	Robinson, Shuford, Combs.
	Aug. 17	Catawba	Robinson, Shuford, Combs.
	Aug. 18	Terrells S. H.	Robinson, Shuford, Combs.
	Aug. 19	St. James S. H.	Robinson, Shuford, Combs.
	Aug. 20	Shuford's Farm	Robinson, Shuford, Combs.
	Aug. 21	Providence S. H.	Robinson, Shuford, Combs.
	Aug. 22	Killian S. H.	Robinson, Shuford, Combs.
	Aug. 29	Minerva S. H.	Robinson, Shuford, Combs.
Chatham	July 24	Siler City	Hendricks, Garren.
Cherokee	Sept. 15	Ranger	Parker, T. B., Cheshire, Perkins.
	Sept. 18	Murphy	Parker, T. B., Cheshire, Perkins.
	Sept. 19	Andrews	Parker, T. B., Cheshire, Perkins.
Chowan	Jan. 29	Edenton	Sherman, Burgess, Sloan.
Clay	Sept. 16	Brasstown	Parker, T. B., Cheshire, Perkins.
	Sept. 17	Hayesville	Parker, T. B., Cheshire, Perkins.
Cleveland	Aug. 11	Casar	Kerr, French, Combs.
	Aug. 12	Belwood	Kerr, French, Combs.
	Aug. 13	Shelby	Kerr, French, Combs.
	Aug. 15	Waco	Kerr, French, Combs.
Columbus	Feb. 7	Old Dock	Garren, Hill.
	Feb. 9	Whiteville	Garren, Shaw.
	Feb. 10	Chadbourn	Garren, Shaw.
	Feb. 11	Tabor	Garren, Shaw.
Craven	Feb. 6	Beech Grove	Kerr, Newell, Sloan.
	Feb. 7	Ernul	Kerr, Newell, Sloan.
Cumberland	Jan. 21	King Hiram S. H.	Garren, Hill, Robertson.
	Jan. 24	Stedman	Garren, Hill, Robertson.
Currituck	Feb. 2	Coinjock	Sherman, Rives.
	Feb. 3	Newbern's Landing	Sherman, Rives.
Davidson	July 24	Enterprise	French, Sloan.
	Aug. 1	Boston S. H.	Hendricks, Garren, Shook.
	Aug. 5	Cedar Springs S. H.	Hendricks, Garren, Shook.
	Aug. 6	Clarksburg	Parker, T. B., Holmes.
Davie	July 27	Farmington	Kerr, French, Sloan.
	July 28	Center Church	Kerr, French, Sloan.
Duplin	Jan. 30	Calypso	Kerr, Newell.
	Feb. 2	Concord	Kerr, Newell.
Durham	July 25	Mineral Springs	Scott, Parker, T. B.
	July 27	Lowe's Grove S. H.	Scott, Parker, T. B.
	Aug. 21	Bahama	Hendricks, Curtis, Garren.
Edgecombe	April —	Dixie S. H.	Burgess.
	Jan. 19	Battleboro	Kerr, Newell.
Forsyth	July 25	Clemmons	French, Sloan.
	Aug. 15	Belew's Creek	Scott, Eaton.
	Aug. 19	Burke's Grove	Scott, Garren.
	Aug. 20	Cold Springs	Scott, Garren.
Franklin	Feb. 25	Louisburg	Parker, T. B., Garren, Sloan.
Gaston	Aug. 17	Sunnyside S. H.	French, Parker, T. F., Combs.
	Aug. 18	Eakers S. H.	French, Parker, T. F., Combs.
	Aug. 21	Stanley	French, Parker, T. F., Combs.
Gates	Feb. 9	Eure	Sherman, Rives.
Granville	Feb. 27	Stovall	Garren, Sloan.
	Feb. 28	Creedmoor	Garren, Parker, T. B.
Guilford	July 29	Pleasant Garden	Hendricks, Shook, Garren.

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FARMERS' INSTITUTES, 1914—Continued.

County	Date	Place	Lecturers
Guilford	July 30	McLeansburg	Hendricks, Shook, Garren.
	July 31	Jamestown	Hendricks, Shook, Garren.
	Aug. 1	Battleground	Scott, Sloan.
	Aug. 21	Colfax	Scott, Garren.
Halifax	Jan. 21	Scotland Neck	Kerr, Newell.
	Feb. 23	Aurelian Springs	Garren, Parker, T. B.
Harnett	Feb. 17	Duke	Garren, Parker, Graham, Hill.
Haywood	Sept. 10	Bethel	Parker, Cheshire, Perkins.
	Sept. 11	Rock Springs	Parker, Cheshire, Perkins.
	Sept. 12	Waynesville	Parker, Cheshire, Perkins.
Henderson	Sept. 2	Liberty S. H.	Parker, Cheshire, Perkins.
	Sept. 5	Mills River	Parker, Cheshire, Perkins.
	Sept. 8	Dana	Parker, Cheshire, Perkins.
	Sept. 9	Fletcher	Parker, Cheshire, Perkins.
Hertford	Feb. 10	Winton	Sherman, Rives.
	Feb. 11	Murfreesboro	Sherman, Rives.
	Feb. 18	Ahoskie	Sherman, Rives.
Hoke	July 29	Raeford	Chrisman, Parker, T. F., Newman.
Hyde	Jan. 22	Swan Quarter	Sherman, Latham, Sloan.
	Jan. 23	Sladesville	Sherman, Latham, Sloan.
Iredell	July 29	Cool Springs	Kerr, French, Sloan.
	July 30	Eupeptic Springs	Kerr, French, Sloan.
	Aug. 1	Test Farm	Kerr, French, Young.
	Aug. 14	Mooresville	Hendricks, Curtis, Owen, Sloan.
Jackson	Sept. 26	Cullowhee	Parker, T. B., Cheshire, McCracken.
Johnston	Jan. 15	Pleasant Hill	Garren, Hill.
	Jan. 15	Micro	Sherman, McLean, Sloan.
	Jan. 16	Sandy Grove	Garren, Hill.
Jones	Feb. 5	Pollocksville	Kerr, Newell, Sloan.
Lee	Oct. 9	Broadway	Garren, Sloan.
	Oct. 10	Sanford	Garren, Sloan.
Lenoir	Jan. 24	LaGrange	Kerr, Newell.
	Feb. 11	Kinston	Kerr, Newell, Sloan.
Lincoln	Aug. 19	Reepsville	French, Parker, T. F., Combs.
	Aug. 20	Lincolnton	French, Parker, T. F., Combs.
Macon	Sept. 21	Franklin	Parker, T. B., Cheshire, McCracken.
	Sept. 22	Maxwell	Parker, T. B., Cheshire, McCracken.
	Sept. 23	Otto	Parker, T. B., Cheshire, McCracken.
	Sept. 24	West Hill S. H.	Parker, T. B., Cheshire, McCracken.
	Sept. 25	Hidgonville	Parker, T. B., Cheshire, McCracken.
Madison	Sept. 28	Marshall	Parker, T. B., Cheshire, McCracken.
	Sept. 29	Mars Hill	Parker, T. B., Cheshire, McCracken.
McDowell	Aug. 7	Marion	Kerr, French, Parker, Garren.
Martin	Jan. 22	Oak City	Kerr, Newell.
	Feb. 7	Williamston	Sherman, Rives.
	June 4	Parmele (colored)	Sloan.
Mecklenburg	Aug. 13	Huntersville	Hendricks, Curtis, Owen, Sloan.
	Aug. 17	Carolina Academy	Chrisman, Kerr, Sloan.
	Aug. 18	Mint Hill	Chrisman, Kerr, Sloan.
	Mar. 6	Biddle University	Garren, Sloan.
	Sept. 4	Biddle University	Sloan, Graeber.
Mitchell	Aug. 12	Bakersville	Parker, Garren, Holmes.
	Aug. 13	Spruce Pine	Parker, Garren, Holmes.
Montgomery	Aug. 1	Candor	Chrisman, Parker, T. F., Newman.
	Aug. 4	Star	Chrisman, Parker, T. F., Sloan.
	Aug. 5	Troy	Chrisman, Parker, T. F., Sloan.
	Aug. 6	Mt. Gilead	Chrisman, Parker, T. F., Sloan.
Moore	July 24	Bethlehem Church	Chrisman, Parker, T. F., Newman.
	July 25	Glendon	Chrisman, Parker, T. F., Newman.

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FARMERS' INSTITUTES, 1914—Continued.

County	Date	Place	Lecturers
Moore	July 27	Cameron	Chrisman, Parker, T. F., Newman.
	July 25	Aberdeen	Chrisman, Parker, T. F., Newman.
	July 30	West End	Chrisman, Parker, T. F., Newman.
	July 31	Big Oak	Chrisman, Parker, T. F., Newman.
Nash	Jan. 15	Stanhope	Kerr, Newell.
	Jan. 16	Nashville	Kerr, Newell.
New Hanover	Jan. 31	Wrightsboro	Garren, Hill.
Northampton	Feb. 12	Conway	Sherman, Rives.
	Feb. 13	Lasker	Sherman, Rives.
	Feb. 14	Rich Square	Sherman, Rives.
Onslow	Feb. 4	Harris Creek S. H.	Kerr, Newell, Sloan.
	Feb. 12	Richlands	Kerr, Newell, Sloan.
Orange	Aug. 22	Hillsboro	Scott, Garren, Parker, T. B.
Pamlico	Feb. 9	Bayboro	Kerr, Newell, Sloan.
Pasquotank	Feb. 4	Elizabeth City	Sherman, Rives.
	Feb. 5	Salem	Sherman, Rives.
Pender	Jan. 29	Atkinson	Garren, Hill, Eaton, Dr. Smith.
	Feb. 2	Burgaw	Garren, Hill, Eaton, Dr. Smith.
	Feb. 3	Willard	Kerr, Newell, Sloan.
	Mar. 17–18	Watha	Parker, Garren, Sloan.
	Nov. 4–5	Watha	Hutt, Hudson, Sloan, Hargett, McVean.
Perquimans	Jan. 30	Hertford	Sherman, Burgess, Sloan.
Person	July 28	Chub Lake	Scott, Parker, T. B., Cuningham.
Pitt	Jan. 17	Grimesland	Sherman, McLean, Sloan.
	Jan. 23	Grifton	Kerr, Newell.
	Feb. 14	Greenville	Kerr, Newell, Sloan.
Polk	Sept. 7	Columbus	Parker, T. B., Cheshire.
Randolph	July 25	Pleasant Ridge	Hendricks, Garren.
	July 27	Liberty	Hendricks, Garren.
	July 28	Providence S. H.	Hendricks, Garren, Shook.
	Aug. 3	Seagrove	Hendricks, Garren, Shook.
	Aug. 4	Farmer	Hendricks, Garren, Shook.
Richmond	Aug. 3	Ellerbe Springs	Chrisman, Parker, T. F., Sloan.
	Aug. 10	Rockingham	Chrisman, Parker, T. F., Young.
Robeson	Jan. 19	Antioch	Garren, Robertson, Shaw.
	Jan. 20	Lumber Bridge	Garren, Robertson, Shaw.
	Jan. 23	St. Pauls	Garren, Robertson, Hill.
	Feb. 12	Fairmont	Garren, Robertson, Shaw.
	Oct. 17	Back Swamp	Parker, T. B.
Rockingham	July 31	Ruffin	Scott, Parker, T. B., Sloan.
	Aug. 13	New Bethel Academy	Scott, Eaton.
	Aug. 14	Stoneville	Scott, Eaton.
Rowan	Aug. 8	Rockwell	Hendricks, Shook.
	Aug. 10	China Grove	Hendricks, Curtis, Owen.
	Aug. 15	Mt. Ulla	Hendricks, Curtis, Owen.
	Aug. 21	Liberty S. H.	Chrisman, Kerr, Sloan.
	Aug. 22	Woodleaf	French, Combs, Parker, T. F.
Rutherford	Aug. 8	Forest City	French, Combs, Kerr.
	Aug. 10	Golden	Kerr, French, Combs.
	Aug. 14	Dobbin's S. H.	Kerr, French, Combs.
Sampson	Jan. 17	Newton Grove	Garren, Hill.
	Jan. 26	Piney Green	Garren, Hill, Eaton.
	Jan. 27	Garland	Garren, Hill, Eaton.
	Jan. 28	Harrells Store	Garren, Hill, Eaton.
	Jan. 31	Beulah S. H.	Kerr, Newell.
		Clinton (colored)	Parker, T. B.

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FARMERS' INSTITUTES, 1914—Continued.

County	Date	Location	Lecturers
Stanly	Aug. 6	Endy, S. H.	Hendricks, Shook.
	Aug. 7	Richfield	Hendricks, Shook.
	Aug. 7	Norwood	Chrisman, Parker, T. F., Sloan.
Stokes	Aug. 11	Walnut Cove	Scott, Eaton, Sloan.
	Aug. 12	Danbury	Scott, Eaton.
Surry	Aug. 17	Piney Grove Church	Scott, Garren.
	Aug. 18	Pilot Mountain	Scott, Garren.
Swain	Sept. 14	Bryson City	Parker, T. B., Cheshire, Perkins.
Transylvania	Sept. 3	Sellca	Garren.
	Sept. 4	Blantyre	Garren, Dr. Owen.
Tyrrell	Jan. 27	Columbia	Sherman, Burgess, Sloan.
Union	Aug. 13	Marshville	Chrisman, Parker, T. F., Young.
	Aug. 14	Marvin	Chrisman, Parker, T. F., Young.
	Aug. 15	Waxhaw	Chrisman, Parker, Sloan.
	Aug. 19	Indian Trail	Chrisman, Kerr, Sloan.
Washington	Jan. 28	Creswell	Sherman, Burgess, Sloan.
	Feb. 6	Plymouth	Sherman, Rives.
Watauga	Sept. 21	Valle Crucis	Sherman, Hudson, Reed.
	Sept. 23	Boone	Sherman, Hudson, Reed.
Wayne	Jan. 26	Seven Springs	Kerr, Newell.
	Jan. 27	Memorial Church	Kerr, Newell.
	Jan. 28	Falling Creek	Kerr, Newell.
	Jan. 29	Smith's Chapel	Kerr, Newell.
		Dudley (colored)	Parker, T. B.
Wilkes	Aug. 3	Millers Creek	Scott.
	Aug. 4	Beaver Creek	Scott, Robinson.
	Aug. 5	Boomer	Scott, Robinson.
	Aug. 6	Newhope Church	Scott, Robinson.
	Aug. 7	Clingman S. H.	Scott, Robinson.
	Sept. 14	Trap Hill	Sherman, Hudson, Reed.
Wilson	Jan. 16	Stantonsburg	Sherman, McLean, Sloan.
	Jan. 17	Rock Ridge	Kerr, Newell.
Yadkin	Aug. 8	Hamptonville	Scott, Sloan.
	Aug. 10	Booneville	Scott, Sloan.
Yancey	Aug. 8	Burnsville	Parker, T. B., Garren, Holmes.
	Aug. 10	Bald Creek	Parker, T. B., Garren, Holmes.
	Aug. 11	Daybook	Parker, T. B., Garren, Holmes.

LECTURERS AND SUBJECTS.

Name	No. Institutes Attended.	Subjects
BROWNE, T. E.	5	Peanut Culture.
District Demonstration Agent.		Corn Culture.
BURGESS, J. L.	9	Farm Crops.
Agronomist, Department of Agriculture.		Soil Building.
CHESHIRE, J. W.	35	The Value of Birds.
Secretary North Carolina Audubon Soc.		
CHRISMAN, W. G.	25	Diseases of Live Stock.
Veterinarian V. P. I.		Growing Live Stock.
COMBS, STANLEY	12	Dairy Farming.
Assistant in Dairy Farming, N. C.		
CUNINGHAM, J. S.	5	Tobacco Culture.
Special Agent in Tobacco Investigation.		

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LECTURERS AND SUBJECTS—Continued

Name	No. Institutes Attended.	Subjects
CURTIS, R. S. Assistant in Animal Husbandry.	14	Beef Production.
EATON, W. H. Dairy Expert.	21	Silo and Silage. Care and Feeding of Dairy Cows. Butter Making.
FRENCH, A. L. Farmer.	26	Soil Improvement with Live Stock.
GARREN, G. M. Assistant Agronomist, Department of Agriculture.	64	Soil Improvement. Corn Culture. Legumes.
HARGETT, E. G. Assistant Veterinarian, Department of Agriculture.	1	Preventing Diseases.
HENDRICKS, M. J. Farmer.	25	Wheat Culture. Corn Culture.
HILL, R. G. Assistant Horticulturist.	24	Apple Culture. Vegetable Gardens.
Holmes, J. S. State Forester.	20	Forest Protection.
HUDSON, C. R. Farm Demonstration Work.	2	Soil Building. Corn Culture.
HUTT, W. N. State Horticulturist.	2	Pecan Growing. Orchard Management.
JOHNSON, J. M. Expert in Farm Management, U. S. Department of Agriculture.	2	Farm Management.
KERR, J. P. Farmer.	52	Poultry. Harvesting Corn.
LATHAM, J. F. Farmer.	7	Crop Rotation.
McCRACKEN, R. P. Farmer.	----	Renovation of Wornout Land. Beef Production. Drainage.
McLEAN, T. D. District Demonstration Agent.	5	Cotton Growing. Soil Improvement.
McVEAN, J. D. Pig Clubs.	1	Swine Management.
MILLSAPS, E. S. District Demonstration Agent.	5	Corn Culture. Cotton Culture. Cooperation.
NEWELL, F. B. Farmer, Demonstration Agent.	27	Cover Crops.
NEWMAN, C. L. Professor of Agriculture, Agricultural and Mechanical College.	8	Soil Improvement. Cotton Culture. Commercial Fertilisers
OWEN, F. D. U. S. Department of Agriculture.	18	Hog Cholera and its Prevention.
PARKER, T. B. Director of Farmers' Institutes, Department of Agriculture.	40	Commercial Fertilisers. Corn and Cotton Culture. Soil Building.
PARKER, T. F. Professor of Agriculture, Porto Rico.	25	Mixing Fertilisers. Cotton Culture.
PERKINS, E. L. Farmer, Demonstration Agent.	14	Cover Crops. Soil Improvement.

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LECTURERS AND SUBJECTS—Continued.

Name	No. Institutes Attended.	Subjects
REED, A. J. Dairy Specialist, U. S. Department of Agriculture.	14	Dairying.
RIVES, J. R. Farmer.	14	Cooperation.
ROBERTSON, A. K. Assistant in Boys' Corn Clubs.	12	Corn Growing.
ROBINSON, JOHN W. Farmer.	10	Dairying. Cooperation.
SHAW, S. B. Assistant Horticulturist, Department of Agriculture.	6	Apple Culture. Spraying and Spray Materials.
SHERMAN, FRANKLIN, JR. State Entomologist, Department of Agriculture.	38	Insect Pests and Their Control.
SCOTT, R. W. Farmer.	25	Diversified Farming.
SHOOK, L. W. Assistant Swine Investigations.	14	Live Stock.
SHUFORD, W. J.	8	Cooperation.
SLOAN, R. L. Assistant Director Farmers' Institutes, Department of Agriculture.	60	Crop Rotation. Soil Fertility.
WILLIAMS, C. B. Assistant Director Experiment Station, Department of Agriculture.		Farm Crops. Lime and its Use.
YOUNG, H. C. Instructor A. & M. College.	14	Plant Diseases.

County and Local Farmers' Institute Organizations.

Farmers' Institute Committees are appointed in all the counties where institutes are held. The duties of the members of the committees are to suggest places where the institutes are to be held, topics for discussion, advertise the meetings, look after the comfort of those attending the meetings, see that the house or hall in which the institute is to be held is put in good order before the hour for the institute to meet.

Farmers' clubs, local Farmers' Alliances, and local Farmers' Unions can greatly help the institutes by coöperating with the local institute committees and the conductor of the institute party. Such coöperation is welcomed.

CHAIRMEN OF COUNTY AND LOCAL FARMERS' INSTITUTE COMMITTEES..

County	Chairman of Committee	Postoffice
Alamance	C. R. Cates	Mebane.
Elon College	W. P. Lawrence	Elon College.
Spring Graded School	Prof. E. P. Dixon	Saxapahaw.
Alexander	J. H. Smith	Taylorsville.
Alleghany	S. F. Thompson	Walls.

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CHAIRMEN OF COUNTY AND LOCAL FARMERS' INSTITUTE COMMITTEES—Continued

County	Chairman of Committee	Postoffice
Anson:		
McFarlan	W. J. McLendon	Morven.
Polkton	J. W. Kiker	Polkton.
Wadesboro	T. H. Knotts	Wadesboro.
Ansonville	S. M. Clark	Ansonville.
Ashe	John Dent	Jefferson.
Scottsville	Ed. Shepherd	Scottsville.
Beaufort	W. D. Grimes	Washington.
Bath	J. B. Archbell	Bath.
Bertie	C. W. Spruill	Quitsna.
Mars Hill	Josiah Brown	Coleraine.
Bladen	R. B. Cromartie	Elisabethtown.
Council	T. A. Jones	Zara.
Tarheel	S. P. Metcalf	Tarheel.
Clarkton	W. J. Cox	Clarkton.
Abbottsburg	F. S. Averitt	Abbottsburg.
Brunswick	Jack Johnson	Winnabow.
Ash	R. M. Long	Ash.
Shallotte	E. M. Parker	Shallotte.
Supply	O. B. Sellers	Supply.
Cool Run School House	J. M. Hewett	Shallotte.
Buncombe:		
Democrat	S. H. Carter	Democrat.
Swannanoa	F. S. Puckett	Swannanoa.
Burke	J. M. Coulter	Connelly Springs.
Hickory Grove	J. A. Lackey	Morganton.
Cabarrus	R. D. Goodman	Concord.
Rimer	M. W. Allman	Concord, No. 4.
Harrisburg	C. L. Sims	Harrisburg.
Mt. Pleasant	W. H. Fisher	Mt. Pleasant.
Caldwell	G. M. Goforth	Lenoir.
Collettsville	C. H. Holloway	Collettsville.
Hudson	C. E. Conley	Lenoir, No. 3.
Camden	W. G. Ferebee	Gregory.
Carteret	D. N. McCain	Newport.
Caswell	J. F. Walters	Blanche.
Leasburg	W. S. Dixon	Leasburg.
Chatham:		
Bynum	R. L. Ward	Riggsbee.
Farrington	J. E. Womble	Apex, No. 4.
Goldston	I. P. Coggins	Bear Creek.
Siler City	J. R. Paschal	Siler City.
Cherokee	G. B. Walker	Andrews.
Murphy	B. M. Ledford	Ranger.
Andrews	D. W. Whisenhunt	Andrews.
Chowan	Z. W. Evans	Tyner.
Clay	W. T. Bumgarner	Hayesville.
Brasstown	Carl Scroggs	Brasstown.
Ogden	G. S. McClure	Ogden.
Elf	W. A. Cassada	Hayesville, No. 1.
Cleveland	J. T. Gardner	Shelby.
Casar	A. A. Warlick	Casar.
Belwood	J. B. Short	Belwood.
Waco	C. C. Beam	Waco.
Columbus	D. Boughner	Chadbourn.
Tabor	Minos Meares	Tabor.
Whiteville	Dr. W. Ross Davis	Whiteville.
Old Dock	C. W. Suggs	Old Dock.
Hallsboro	J. A. Wyche	Hallsboro.

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CHAIRMEN OF COUNTY AND LOCAL FARMERS' INSTITUTE COMMITTEES—Continued.

County	Chairman of Committee	Postoffice
Craven	W. H. Bray	New Bern.
Vanceboro	O. McLawhorne	Vanceboro.
Beach Grove	G. T. Richardson	New Bern.
Ernul	D. P. Whitford	Askin.
Cumberland	W. H. Downing	Fayetteville.
Stedman	R. S. Autry	Stedman.
King Hiram	J. H. Smith	Hope Mills.
Currituck	J. J. Ferebee	Shawboro.
Davidson:		
Boston S. H.	D. S. Hayworth	High Point.
Cedar Springs	J. R. Crouse	Cid.
Enterprise	Luther Nifong	Winston-Salem, No. 4.
Davie	W. R. Clement	Mocksville.
Farmington	A. W. Ellis	Farmington.
Center Church	E. B. Barneycastle	Mocksville.
Mock, S. H.	B. S. Orrell	Advance.
Duplin	J. A. Shine	Faison.
Calypso	J. T. Albritton	Mt. Olive.
Rose Hill	Maury Ward	Rose Hill.
Faison	H. J. Faison	Faison.
Durham	J. M. Gray	Durham.
Mineral Springs	A. C. Weatherly	Gorman.
Lowe's Grove	J. C. High	Durham.
Edgecombe	G. T. DeBerry	Tarboro.
Conetoe	N. B. Dawson	Conetoe.
Whitakers	M. J. Battle	Whitakers.
Speed	B. F. Shelton	Speed.
Forsyth	A. B. Atwood	Winston-Salem.
Belew's Creek	J. E. Sapp	Belew's Creek.
Burke Grove	P. E. Burke	Winston-Salem, No. 1.
Cold Spring	C. E. Ebert	Winston-Salem.
Clemmons	T. W. Griffith	Clemmons.
Franklin	T. B. Wilder	Louisburg.
Franklinton	J. C. Winston	Franklinton.
Gaston	E. D. Thompson	Stanley.
Sunnyside S. H.	H. S. Sellers	Kings Mountain.
Chapel Church	E. A. Hurley	Gastonia.
Gates	W. J. Boone	Drum Hill.
Eure	T. E. Story	Eure.
Granville	E. G. Moss	Creedmoor.
Stovall	C. L. Lewis	Stovall.
Creedmoor	C. H. Cozart	Creedmoor.
Greene	W. R. Dixon	Snow Hill.
Grimsley's Church	J. T. Dixon	Farmville.
Guilford:		
Pleasant Garden	C. E. Hockart	Pleasant Garden.
McLeansburg	Junius Boone	McLeansburg.
Jamestown	W. L. Kivett	High Point.
Battleground	J. C. Frazier	Guilford College.
Colfax	W. L. Gibbons	Colfax.
Halifax	J. H. Sherrod	Enfield.
Scotland Neck	G. W. Bryan	Scotland Neck.
Littleton	Claude Sessoms	Littleton.
Aurelian Springs	J. R. Patterson	Littleton.
Harnett	C. McArtan	Lillington.
Coats	T. D. Stewart	Coats.
Duke	A. F. Fowler	Duke.
Haywood	Dr. G. D. Green	Waynesville.
Bethel	M. D. Kinsland	Waynesville.
Rock Hill	J. H. Allison	Dellwood.

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CHAIRMEN OF COUNTY AND LOCAL FARMERS' INSTITUTE COMMITTEES—Continued.

County	Chairman of Committee	Postoffice
Haywood:		
Canton	E. F. G. Murry	Canton.
Henderson	J. P. Fletcher	Fletcher.
Green River S. H.	J. W. Ward	Zirconia.
Dana	Sam. L. Rau	Hendersonville.
Liberty	R. A. McKillop	Hendersonville.
Hertford	A. I. Parker	Winton.
Ahoskie	A. E. Garrett	Ahoskie.
Murfreesboro	J. J. Parker	Murfreesboro.
Hoke	W. M. McLean	Raeford.
Hyde	Chas. Brinn	Swan Quarter.
Middletown	J. S. Mann	Middletown.
Iredell	J. W. Sherrill	Statesville, No. 6.
Mooresville	T. J. Williams	Mooresville.
Cool Springs	J. L. Abernathy	Elmwood.
Eupeptic Springs	J. K. Patterson	Statesville.
Jackson:		
Quallatown	J. E. Rogers	Whittier.
Cullowhee	F. H. Brown	Cullowhee.
Johnston	W. M. Sanders	Smithfield.
Kenly	L. B. Boyette	Kenly.
Benson	J. F. Lee	Benson.
Jones	T. C. Whitaker	Trenton.
Pollocksville	A. H. White	Pollocksville.
Lenoir	G. F. Loftin	Kinston.
LaGrange	J. E. Jones	LaGrange.
Lee	J. R. Rives	Sanford.
Lincoln	T. J. Ramseur	Lincolnton.
McDowell	E. S. Frisbie	Marion.
Macon	Arthur Siler	Franklin.
Maxwell S. H.	C. B. Yeargan	Franklin.
Otto	D. P. Cabe	Otto.
Higdonville	Parker Moore	Ellijay.
West's Mill	J. W. Murry	West's Mill.
Madison	L. M. Bryan	Marshall.
Mars Hill	A. F. Sprinkle	Mars Hill.
Martin	S. E. Hardison	Williamston.
Oak City	N. M. Worsley	Oak City.
Mecklenburg	C. C. Moore	Charlotte.
Huntersville	A. B. McAuley	Huntersville.
Carolina Academy	R. M. Bryant	Matthews, No. 17.
Bains Academy	D. A. Henderson	Matthews, No. 19.
Mitchell	Jos. Bowditch	Toecane.
Spruce Pine	N. S. Lawrence	Spruce Pine.
Montgomery	Clyde Caple	Troy.
Candor	D. C. Ewing	Candor.
Star	G. N. Scarboro	Star.
Mt. Gilead	R. A. Bruton	Mt. Gilead.
Moore	T. D. McLean	Carthage.
Bethlehem Church	J. A. Fry	Carthage.
Glendon	A. J. Jones	Glendon.
Cameron	N. P. McPherson	Cameron.
Aberdeen	D. J. Campbell	Aberdeen.
West End	W. P. Corcoran	West End.
Big Oak	D. C. McKinnie	Bisco.
Nash	S. F. Austin	Nashville.
Stanhope H. S.	S. H. Brantley	Springhope.
New Hanover	Wm. Gregerson	Castle Hayne.

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CHAIRMEN OF COUNTY AND LOCAL FARMERS' INSTITUTE COMMITTEES—Continued.

County	Chairman of Committee	Postoffice
Northampton	J. W. Jessup	Rich Square.
Rich Square	W. E. Spivey	Rich Square.
Lasker	C. S. Lasker	Lasker.
Conway	J. O. Flythe	Conway.
Onslow	J. L. Nicholson	Richlands.
Richlands	J. M. Francke	Richlands.
Harris Creek	H. H. Shepherd	Cyrus.
Orange	A. H. Rimmer	Hillsboro.
Pamlico	G. T. Farnell	Bayboro.
Pasquotank	R. N. Morgan	Elizabeth City.
Weeksville	H. M. Pritchard	Weeksville.
Pender	W. M. Hand	Burgaw.
Atkinson	Geo. J. Moore	Atkinson.
Willard	J. H. Jeffries	Willard.
Perquimans	J. O. White	Hertford.
Person	J. W. Younger	Roxboro.
Pitt	J. F. Evans	Greenville.
Grifton	J. P. Quinerly	Grifton.
Grimesland	H. J. Smith	Grimesland.
Polk	T. T. Ballinger	Tryon.
Randolph:		
Pleasant Ridge	J. O. Forester	Ramseur.
Liberty	J. M. Williams	Liberty.
Providence S. H.	S. W. White	Climax.
Seagrove	O. D. Lawrence	Seagrove.
Farmer	L. M. Kearn	Farmer.
Richmond	W. C. Leak	Rockingham.
Ellerbe	E. L. Pegram	Ellerbe.
Robeson	J. A. McAllister	Lumberton.
Parkton	W. S. Cobb	Parkton.
St. Paul	G. M. D. Howard	St. Paul.
Lumber Bridge	Neil Shaw	Lumber Bridge.
Fairmont	N. T. Andrews	Fairmont.
Red Springs	J. D. McLean	Red Springs.
Rockingham	J. V. Price	Madison.
Ruffin	John L. Williams	Pelham.
New Bethel	J. S. McCollum	Madison.
Rowan:		
Rockwell	C. H. Fisher	Rockwell.
China Grove	M. A. Stirewalt	China Grove.
Mt. Ulla	J. K. Goodman	Mt. Ulla.
Liberty S. H.	P. N. Trexler	Gold Hill.
Rutherford	J. M. Jones	Ruthertordton.
Forest City	G. T. Moore	Forest City.
Ellenboro	G. S. Harrill	Ellenboro.
Sampson	S. H. Hobbs	Clinton.
Newton Grove	J. W. Bryan	Newton Grove.
Roseboro	D. W. Culbreth	Roseboro.
Garland	J. D. Johnson	Garland.
Spring Branch	W. A. Jackson	Cooper.
Scotland	W. N. McKenzie	Gibson.
Stanly	S. J. Lynch	Shankle.
Endy S. H.	W. A. Harward	Bridgeport.
Richfield	E. D. Coggins	New London.
Stokes	I. G. Ross	Walnut Cove.
Walnut Cove	Chap. Bodenheimer	Germanton.
Surry:		
Piney Grove	J. L. Jackson	Mt. Airy.
Pilot Mountain	D. J. Denney	Pinnacle.
Swain	R. L. Sandidge	Bryson City.

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CHAIRMEN OF COUNTY AND LOCAL FARMERS' INSTITUTE COMMITTEES—Continued.

County	Chairman of Committee	Postoffice
Transylvania	W. H. Grogan	Brevard.
Selica	C. C. Duckworth	Selica.
Tyrrell	W. W. Sawyer	Columbia.
Union:		
Marshville	F. A. Marsh	Marshville.
Marvin	G. W. Sutton	Waxhaw.
Waxhaw	J. R. Eason	Waxhaw.
Indian Trail	J. W. Rollings	Indian Trail.
Vance	J. B. Allen	Henderson.
Middleburg	J. K. Plummer	Middleburg.
Wake	W. H. Chamblee, Jr.	Zebulon.
Warren	H. T. Macon	Warrenton.
Wise	P. R. Perkinson	Wise.
Washington	T. W. Blount	Roper.
Creswell	W. T. Hopkins	Creswell.
Wayne	J. M. Mitchell	Goldsboro.
Smith Chapel	W. B. Hood	Mt. Olive.
Pikeville	E. T. Crawford	Pikeville.
Hood Swamp	J. F. Smith	Aaron.
Falling Creek	G. M. Warrick	Goldsboro, No. 4.
Memorial Church	C. D. Hooks	Fremont.
Seven Springs	G. G. Quinn	Seven Springs.
Wilkes	A. G. Hendren	Straw.
Millers Creek	J. M. Gaither	Wilkesboro.
Beaver Creek	T. J. James	North Wilkesboro.
Boomer	M. S. Gibbs	Boomer.
New Hope Church	J. J. Hendren	Gilreath.
Clingman S. H.	T. F. Callaway	Ronda.
Wilson	E. B. Dean	Wilson.
Yadkin	A. S. Speer	Boonville.
Hamptonville	D. D. Angell	Hamptonville.
Yancey	E. F. Watson	Burnsville.

STATE FARMERS' CONVENTION.

B. F. Shelton	President	Speed, N. C.
W. S. Pharr	Vice-President	Charlotte, N. C.
J. B. Sellars	Vice-President	Maxton, N. C.
D. P. Whitford	Vice-President	Askin, N. C.
T. E. Browne	Secretary	Raleigh, N. C.

WOMEN'S INSTITUTES, 1914.

County	Date	Place	Lecturers
Alamance	Aug. 17	Elon College	Miss Webb, Mrs. Robinson.
	Aug. 18	Maywood	Miss Webb, Mrs. Robinson.
	Aug. 19	Spring Graded School	Miss Webb, Mrs. Robinson.
	Aug. 20	Hawfields Graded School	Miss Webb, Mrs. Robinson.
	Oct. 23	Springhope	Miss Hudgins.
Alexander	July 31	Taylorsville	Mrs. Hollowell, Miss Parris.
Alleghany	Sept. 14	Glade Valley	Miss Ward, Miss Cassidey.
	Sept. 15	Sparta	Miss Ward, Miss Cassidey.
	Sept. 16	Whitehead	Miss Ward, Miss Cassidey.
Anson	Aug. 8	McFarlan	Mrs. Hutt, Miss Clement.
	Aug. 11	Polkton	Mrs. Hutt, Miss Clement.

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WOMEN'S INSTITUTES, 1914—Continued.

County	Date	Place	Lecturers
Anson	Aug. 12	Wadesboro	Mrs. Hutt, Miss Clement.
	Aug. 20	Ansonville	Mrs. Hutt, Miss Clement.
		Mrs. Redfern's S. H.	Mrs. Hutt.
		McFarlan	Mrs. Hutt.
		Dr. McLendon's	Mrs. Hutt.
		Morven	Mrs. Hutt.
		Polkton	Mrs. Hutt.
		Ansonville	Mrs. Hutt.
		Wadesboro	Mrs. Hutt.
Ashe	Sept. 17	Scottville	Miss Ward, Miss Cassidey.
	Sept. 18	Grassy Creek	Miss Ward, Miss Cassidey.
	Sept. 19	Jefferson	Miss Ward, Miss Cassidey.
Avery	Sept. 22	Banners Elk	Miss Ward, Miss Cassidey.
Beaufort	Oct. 28	Bath	Miss Hudgins.
	Jan. 19	Bath	Miss Ward, Miss Carroll.
	Jan. 20	Aurora	Miss Ward, Miss Carroll.
	Jan. 21	Washington	Miss Ward, Miss Carroll.
	Jan. 24	Pantego	Miss Ward, Miss Carroll.
Bertie	Feb. 16	Mars Hill	Miss Ward, Mrs. Maddry.
	Feb. 17	Windsor	Miss Ward, Mrs. Maddry.
Bladen	Jan. 22	Tarheel	Miss Webb, Mrs. Hollowell.
Brunswick	Feb. 3	Winnabow	Miss Webb, Mrs. Hollowell.
	Feb. 4	Mt. Pisgah	Miss Webb, Mrs. Hollowell.
	Feb. 5	Thomas S. H.	Miss Webb, Mrs. Hollowell.
	Feb. 6	Ash	Miss Webb, Mrs. Hollowell.
Buncombe	Sept. 1	Swannanoa	Miss Hudgins, Mrs. Slagle.
	Sept. 30	Sand Hill	Miss Hudgins.
Burke	Aug. 5	Hildebran	Mrs. Hollowell, Miss Parris.
	Aug. 6	Hickory Grove	Mrs. Hollowell, Miss Parris.
Cabarrus	Aug. 11	Rimer	Miss Webb, Mrs. Robinson.
	Aug. 12	Concord	Miss Webb, Mrs. Robinson.
Caldwell	Aug. 3	Collettsville	Mrs. Hollowell, Miss Parris.
	Aug. 4	Hudson	Mrs. Hollowell, Miss Parris.
Camden	Jan. 31	Camden C. H.	Miss Ward, Miss Carroll.
Carteret	Feb. 10	Newport	Miss Hudgins, Miss Mahler.
Caswell	July 29	Leasburg	Miss Hudgins, Miss Mahler.
	July 30	Semora	Miss Hudgins, Miss Mahler.
Catawba	Aug. 14	Cloninger's Farm	Mrs. Yoder, Miss Setzer.
	Aug. 15	Rockett S. H.	Mrs. Yoder, Miss Setzer.
	Aug. 17	Catawba	Mrs. Nifong, Miss Yoder.
	Aug. 18	Terrell's Store	Mrs. Nifong, Miss Yoder.
	Aug. 19	St. James S. H.	Mrs. Nifong, Miss Yoder.
	Aug. 20	Shuford's Farm	Mrs. Nifong, Miss Setzer, Miss Yoder.
	Aug. 21	Providence S. H.	Mrs. Nifong, Miss Yoder.
	Aug. 22	Killian S. H.	Miss Setzer, Mrs. Robinson.
	Aug. 29	Minerva S. H.	Mrs. Robinson.
Chatham	July 24	Siler City	Miss Webb, Mrs. Robinson.
Cherokee	Sept. 15	Ranger	Miss Hudgins, Mrs. Slagle.
	Sept. 18	Murphy	Miss Hudgins, Mrs. Slagle.
	Sept. 19	Andrews	Miss Hudgins, Mrs. Slagle.
Chowan	Jan. 29	Edenton	Miss Ward, Miss Carroll.
Clay	Sept. 16	Brasstown	Miss Hudgins, Mrs. Slagle.
	Sept. 17	Hayesville	Miss Hudgins, Mrs. Slagle.
Cleveland	Aug. 11	Casar	Mrs. Hollowell, Miss Arey.
	Aug. 12	Belwood	Mrs. Hollowell, Miss Arey.
	Aug. 13	Shelby	Mrs. Hollowell, Miss Arey.
	Aug. 15	Waco	Mrs. Hollowell, Miss Arey.
Columbus	Feb. 7	Old Dock	Mrs. Hollowell, Miss Webb.
	Feb. 9	Whiteville	Mrs. Hollowell, Miss Webb.

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WOMEN'S INSTITUTES, 1914—Continued.

County	Date	Place	Lecturers
Columbus	Feb. 10	Chadbourn	Mrs. Hollowell, Miss Webb.
	Feb. 11	Tabor	Mrs. Hollowell, Miss Webb.
Craven	Feb. 6	Beech Grove	Miss Hudgins, Miss Mahler.
	Feb. 7	Ernul	Miss Hudgins, Miss Mahler.
Cumberland	Jan. 21	King Hiram S. H.	Mrs. Hollowell, Miss Mahler.
	Jan. 24	Stedman	Mrs. Hollowell, Miss Mahler.
Currituck	Feb. 2	Coinjock	Miss Ward, Mrs. Maddry.
	Feb. 3	Newbern's Landing	Miss Ward, Mrs. Maddry.
Davidson	July 24	Enterprise	Mrs. Hollowell, Miss Parris.
	Aug. 1	Boston S. H.	Miss Webb, Mrs. Robinson.
	Aug. 5	Cedar Springs	Miss Webb, Mrs. Robinson.
	Aug. 6	Clarksburg	Miss Parker, Miss Arey.
Davie	July 27	Farmington	Mrs. Hollowell, Miss Parris.
	July 28	Center Church	Mrs. Hollowell, Mrs. Parris.
Duplin	Jan. 30	Calypso	Miss Hudgins, Miss Mahler.
	Feb. 2	Concord	Miss Hudgins, Miss Mahler.
Durham	July 25	Mineral Springs	Miss Hudgins, Miss Mahler.
	July 27	Lowe's Grove	Miss Hudgins, Miss Mahler.
	Aug. 21	Bahama	Miss Webb, Mrs. Robinson.
Edgecombe	Jan. 19	Battleboro	Miss Hudgins, Miss Mahler.
		Dixie S. H.	Miss Hudgins,.
Forsyth	July 25	Clemmons	Mrs. Hollowell, Miss Parris.
	Aug. 15	Belew's Creek	Miss Hudgins, Miss Mahler.
	Aug. 19	Burke's Grove	Miss Hudgins, Miss Mahler.
	Aug. 20	Cold Springs	Miss Hudgins, Miss Mahler.
Franklin	Feb. 25	Louisburg	Miss Hudgins.
Gaston	Aug. 17	Sunnyside S. H.	Mrs. Hollowell, Miss Arey.
	Aug. 18	Eakers S. H.	Mrs. Hollowell, Miss Arey.
	Aug. 21	Stanley	Mrs. Hollowell, Miss Arey.
Gates	Feb. 9	Eure	Miss Ward, Mrs. Maddry.
Granville	Feb. 27	Stovall	Miss Hudgins.
	Feb. 28	Creedmoor	Miss Hudgins.
Guilford	July 29	Pleasant Garden	Miss Webb, Mrs. Robinson.
	July 30	McLeansburg	Miss Webb, Mrs. Robinson.
	July 31	Jamestown	Miss Webb, Mrs. Robinson.
	Aug. 1	Battleground	Miss Hudgins, Miss Mahler.
	Aug. 21	Colfax	Miss Hudgins, Miss Mahler.
Halifax	Jan. 20	Enfield	Miss Ward, Mrs. Maddry.
	Jan. 21	Scotland Neck	Miss Ward, Mrs. Maddry.
	Feb. 23	Aurelian Springs	Miss Hudgins.
Harnett	Feb. 17	Duke	Mrs. Hollowell, Miss Webb.
Haywood	Sept. 10	Bethel	Miss Hudgins, Mrs. Slagle.
	Sept. 11	Rock Springs	Miss Hudgins, Mrs. Slagle.
	Sept. 12	Waynesville	Miss Hudgins, Mrs. Slagle.
Henderson	Sept. 2	Liberty S. H.	Miss Hudgins, Mrs. Slagle.
	Sept. 5	Mills River	Miss Hudgins, Mrs. Slagle.
	Sept. 8	Dana	Miss Hudgins, Mrs. Slagle.
	Sept. 9	Fletcher	Miss Hudgins, Mrs. Slagle.
Hertford	Feb. 10	Winton	Miss Ward, Mrs. Maddry.
	Feb. 11	Murfreesboro	Miss Ward, Mrs. Maddry.
	Feb. 18	Ahoskie	Miss Ward, Mrs. Maddry.
Hoke	July 29	Raeford	Mrs. Hutt, Miss Clement.
Hyde	Jan. 22	Swan Quarter	Miss Ward, Miss Carroll.
	Jan. 23	Sladesville	Miss Ward, Miss Carroll.
Iredell	July 29	Cool Springs	Mrs. Hollowell, Miss Parris.
	July 30	Eupeptic Springs	Mrs. Hollowell, Miss Parris.
	Aug. 1	Test Farm	Mrs. Hollowell, Miss Parris.
	Aug. 14	Mooresville	Miss Webb, Mrs. Robinson.
Jackson	Sept. 26	Cullowhee	Miss Hudgins.

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WOMEN'S INSTITUTES, 1914—Continued.

County	Date	Place	Lecturers
Johnston	Jan. 15	Pleasant Hill	Miss Webb, Mrs. Hollowell.
	Jan. 15	Micro	Miss Ward, Miss Carroll.
	Jan. 16	Sandy Grove	Miss Webb, Mrs. Hollowell.
Jones	Feb. 5	Pollocksville	Miss Hudgins, Miss Mahler.
Lee	Oct. 9	Broadway	Miss Hudgins, Miss Scott.
	Oct. 10	Sanford	Miss Hudgins, Miss Scott.
Lenoir	Jan. 24	LaGrange	Miss Hudgins, Miss Mahler.
	Feb. 11	Kinston	Miss Hudgins, Miss Mahler.
Macon	Sept. 21	Franklin	Miss Hudgins, Mrs. Slagle.
	Sept. 22	Maxwell S. H.	Miss Hudgins, Mrs. Slagle.
	Sept. 23	Otto	Miss Hudgins, Mrs. Slagle.
	Sept. 24	West Hill	Miss Hudgins, Mrs. Slagle.
	Sept. 25	Higdonville	Miss Hudgins, Mrs. Slagle.
Madison	Sept. 28	Marshall	Miss Hudgins, Mrs. Slagle.
	Sept. 29	Mars Hill	Miss Hudgins, Mrs. Slagle.
Martin	Jan. 22	Oak City	Miss Ward, Mrs. Maddry.
	Feb. 7	Williamston	Miss Ward, Mrs. Maddry.
McDowell	Aug. 7	Marion	Mrs. Hollowell, Miss Parris.
Mecklenburg	Aug. 13	Huntersville	Miss Webb, Mrs. Robinson.
	Aug. 17	Carolina Academy	Mrs. Hutt, Miss Clement.
	Aug. 18	Mint Hill	Mrs. Hutt, Miss Clement.
	Mar. 6	Biddle University	Miss Hudgins.
	June 4	Biddle University	Mrs. Orr.
Mitchell	Aug. 12	Bakersville	Miss Parker, Miss Arey.
	Aug. 13	Spruce Pine	Miss Parker, Miss Arey.
Montgomery	Aug. 1	Candor	Mrs. Hutt, Miss Clement.
	Aug. 4	Star	Mrs. Hutt, Miss Clement.
	Aug. 5	Troy	Mrs. Hutt, Miss Clement.
	Aug. 6	Mt. Gilead	Mrs. Hutt, Miss Clement.
Moore	July 24	Bethlehem Church	Mrs. Hutt, Miss Clement.
	July 25	Glendon	Mrs. Hutt, Miss Clement.
	July 27	Cameron	Mrs. Hutt, Miss Clement.
	July 28	Aberdeen	Mrs. Hutt, Miss Clement.
	July 30	West End	Mrs. Hutt, Miss Clement.
	July 31	Big Oak	Mrs. Hutt, Miss Clement.
Nash	Jan. 15	Stanhope	Miss Hudgins, Miss Webb.
	Jan. 16	Nashville	Miss Hudgins, Miss Webb.
New Hanover	Jan. 31	Wrightsboro	Mrs. Hollowell, Miss Webb.
Northampton	Feb. 12	Conway	Miss Ward, Mrs. Maddry.
	Feb. 13	Lasker	Miss Ward, Mrs. Maddry.
	Feb. 14	Rich Square	Miss Ward, Mrs. Maddry.
Onslow	Feb. 4	Harris Creek S. H.	Miss Hudgins, Miss Mahler.
	Feb. 12	Richlands	Miss Hudgins, Miss Mahler.
Orange	Aug. 22	Hillsboro	Miss Hudgins, Miss Mahler.
Pamlico	Feb. 9	Bayboro	Miss Hudgins, Miss Mahler.
Pasquotank	Feb. 4	Elizabeth City	Miss Ward, Mrs. Maddry.
	Feb. 5	Salem	Miss Ward, Mrs. Maddry.
Pender	Jan. 29	Atkinson	Mrs. Hollowell, Miss Webb.
	Feb. 2	Burgaw	Mrs. Hollowell, Miss Webb.
	Feb. 3	Willard	Miss Hudgins, Miss Mahler.
	Mar. 17-18	Watha	Miss Hudgins, Mrs. Hollowell.
	Nov. 4-5	Watha	Miss Hudgins, Mrs. Hutt.
Perquimans	Jan. 30	Hertford	Miss Ward, Miss Carroll.
Person	July 28	Chublake	Miss Hudgins, Miss Mahler.
Pitt	Jan. 17	Grimesland	Miss Ward, Miss Carroll.
	Jan. 23	Grifton	Miss Hudgins, Miss Webb.
	Feb. 14	Greenville	Miss Hudgins, Miss Mahler.

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WOMEN'S INSITTUTES, 1914—Continued.

County	Date	Place	Lecturers
Polk	Sept. 7	Columbus	Miss Hudgins, Mrs. Slagle.
Randolph	July 25	Pleasant Ridge	Miss Webb, Mrs. Robinson.
	July 27	Liberty	Miss Webb, Mrs. Robinson.
	July 28	Providence S. H.	Miss Webb, Mrs. Robinson.
	Aug. 3	Seagrove	Miss Webb, Mrs. Robinson.
	Aug. 4	Farmer	Miss Webb, Mrs. Robinson.
Richmond	Aug. 3	Ellerbe Springs	Mrs. Hutt, Miss Clement.
	Aug. 10	Rockingham	Mrs. Hutt, Miss Clement.
	Oct. 30-31	Rockingham	Mrs. Hutt.
Robeson	Jan. 19	Antioch	Mrs. Hollowell, Miss Mahler.
	Jan. 20	Lumber Bridge	Mrs. Hollowell, Miss Mahler.
	Jan. 23	St. Paul	Mrs. Hollowell, Miss Mahler.
	Feb. 12	Fairmont	Mrs. Hollowell, Miss Webb.
	Oct. 17	Back Swamp	Mrs. Hutt.
Rockingham	July 31	Ruffin	Miss Hudgins, Miss Mahler.
	Aug. 13	New Bethel	Miss Hudgins, Miss Mahler.
	Aug. 14	Stoneville	Miss Hudgins, Miss Mahler.
Rowan	Aug. 8	Rockwell	Miss Webb, Mrs. Robinson.
	Aug. 10	China Grove	Miss Webb, Mrs. Robinson.
	Aug. 15	Mount Ulla	Miss Webb, Mrs. Robinson.
	Aug. 21	Liberty S. H.	Mrs. Hutt, Miss Clement.
	Aug. 22	Woodleaf	Mrs. Hollowell, Miss Arey.
Rutherford	Aug. 8	Forest City	Mrs. Hollowell, Miss Arey.
	Aug. 10	Golden	Mrs. Hollowell, Miss Arey.
	Aug. 14	Dobbins S. H.	Mrs. Hollowell, Miss Arey.
Sampson	Jan. 17	Newton Grove	Mrs. Hollowell, Miss Mahler.
	Jan. 26	Piney Green	Mrs. Hollowell, Miss Mahler.
	Jan. 27	Garland	Mrs. Hollowell, Miss Mahler.
	Jan. 28	Harrells Store	Mrs. Hollowell, Miss Mahler.
	Jan. 31	Beulah S. H.	Miss Hudgins, Miss Mahler.
		Clinton (colored)	Miss Hudgins.
Stanly	Aug. 6	Endy S. H.	Miss Webb, Mrs. Robinson.
	Aug. 7	Norwood	Mrs. Hutt, Miss Clement.
	Aug. 7	Richfield	Miss Webb, Mrs. Robinson.
Stokes	Aug. 11	Walnut Cove	Miss Hudgins.
	Aug. 12	Danbury	Miss Hudgins.
Surry	Aug. 17	Piney Grove Church	Miss Hudgins, Miss Mahler.
	Aug. 18	Pilot Mountain	Miss Hudgins, Miss Mahler.
Swain	Sept. 14	Bryson City	Miss Hudgins, Mrs. Slagle.
Transylvania	Sept. 3	Selica	Miss Hudgins, Mrs. Slagle.
	Sept. 4	Blantyre	Miss Hudgins, Mrs. Slagle.
Tyrrell	Jan. 27	Columbia	Miss Ward, Miss Carroll.
Union	Aug. 13	Marshville	Mrs. Hutt, Miss Clement.
	Aug. 14	Marvin	Mrs. Hutt, Miss Clement.
	Aug. 15	Waxhaw	Mrs. Hutt, Miss Clement.
	Aug. 19	Indian Trail	Mrs. Hutt, Miss Clement.
Washington	Jan. 28	Creswell	Miss Ward, Miss Carroll.
	Feb. 6	Plymouth	Miss Ward, Mrs. Maddry.
Watauga	Sept. 21	Valle Crucis	Miss Ward, Miss Cassidey.
	Sept. 23	Boone	Miss Ward, Miss Cassidey.
Wayne	Jan. 26	Seven Springs	Miss Hudgins, Miss Mahler.
	Jan. 27	Memorial Church	Miss Hudgins, Miss Mahler.
	Jan. 28	Falling Creek	Miss Hudgins, Miss Mahler.
	Jan. 29	Smith's Chapel	Miss Hudgins, Miss Mahler.
		Dudley (Colored)	Miss Hudgins
Wilkes	Aug. 3	Millers Creek	Miss Hudgins, Miss Mahler.
	Aug. 4	Beaver Creek	Miss Hudgins, Miss Mahler.
	Aug. 5	Boomer	Miss Hudgins, Miss Mahler.
	Aug. 6	New Hope Church	Miss Hudgins, Miss Mahler.

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WOMENS' INSTITUTE—Continued.

County	Date	Location	Lecturers
Wilkes	Aug. 7	Clingman S. H	Miss Hudgins, Miss Mahler.
	Sept. 4	Trap Hill	Miss Ward, Miss Cassidey.
Wilson	Jan. 16	Stantonsburg	Miss Ward, Miss Carroll.
	Jan. 17	Rock Ridge	Miss Hudgins, Miss Mahler.
Yadkin	Aug. 8	Hamptonville	Miss Hudgins, Miss Mahler.
	Aug. 10	Boonville	Miss Hudgins, Miss Mahler.
Yancey	Aug. 8	Burnsville	Miss Parker, Miss Arey.
	Aug. 10	Bald Creek	Miss Parker, Miss Arey.
	Aug. 11	Daybook	Miss Parker, Miss Arey.

LECTURERS AND SUBJECTS.

Name	No. Institutes Attended	Subjects
AREY, MISS BEULAH	12	Bread Making. Kitchen Conveniences.
CARROLL, MISS LAURA H	21	Milk in the Home. Making Pin Money.
CASSIDEY, MISS LULA	12	Community Organization. Sanitary Closets and Flies.
CLEMENT, MISS LINDA	25	School Lunches. Bread Making.
HOLLOWELL, MRS. W. R.	53	Care of Infants. Value of Foods. Bread Making. The Country Woman and Her Relation to Home and Community.
HUDGINS, MISS CARRIE	65	The Country Home. Child Training. Canning. Home Nursing.
HUTT, MRS. W. N.	30	Influence of Foods. Care of Infants. What to Do Till the Doctor Comes.
MAHLER, MISS LOUISE	50	Kitchen Conveniences. Biscuit Demonstration. Bread Making.
PARKER, MISS KATHARINE	10	Breads and Bread Making. Health Hints.
PARRIS, MISS MARIA	18	Bread Making. Salads.
ROBINSON, MRS. J. W.	27	Sanitation in Country. Curing of Meat.
SLAGLE, MRS. HENRY	25	Home Conveniences. Country Women's Organizations.
WARD, MISS JANE E.	38	Home Care of the Sick. Bread Making.
WEBB, MISS LUCIE	53	Fireless Cooker. Bread Making.

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County and Local Women's Organizations.

The plan of organization of the women's institute is similar to that for men. Active interested women are selected for chairmen and secretaries and they are given the best committees that can be selected to assist them. The officers and committees are expected to work up interest in women's institutes and endeavor to get the coöperation of the progressive farm women of the community in securing attendance at their local meetings and also at the annual institutes. They are expected to hold meetings at their convenience during the year to discuss among themselves questions pertaining to their work. They should invite the women of the community to join them at their meetings and take part in the discussions.

CHAIRMEN WOMEN'S INSTITUTE COMMITTEES.

Alamance:		
Maywood	Mrs. B. M. Faucette	Burlington.
Hawfields	Miss Mamie Schoo	Haw River.
Alexander	Mrs. W. J. Reece	Liledoun.
Alleghany	Mrs. T. J. Carson	Sparta.
Scottsville	Mrs. E. K. Plummer	Scottsville.
Anson	Mrs. J. G. Boylin	Wadesboro.
McFarlan	Mrs. W. G. McLendon	McFarlan.
Polkton	Mrs. L. L. Cameron	Polkton.
Ashe	Mrs. C. H. Smithdeal	Jefferson.
Grassy Creek	Mrs. Ed. Greer	Grassy Creek.
Beaufort	Mrs. H. W. Carter	Washington.
Bath	Mrs. T. A. Brooks	Bath.
Aurora	Mrs. B. T. Bonner	Aurora.
Pantego	Mrs. J. B. Respass	Pantego.
Bertie	Miss Clara M. Pigg	Coleraine.
Bladen	Mrs. M. R. Roberson	Tarheel.
Brunswick	Mrs. Jack Johnson	Winnabow.
Mt. Pisgah	Mrs. G. W. Kirby	Supply.
Buncombe	Miss Dala Alexander	Swannanoa.
Cabarrus	Mrs. G. F. Barnhardt	Concord.
Rimer	Mrs. J. A. Suther	Concord.
Caldwell:		
Granite Falls	Mrs. J. M. Yount	Granite Falls.
Oak Hill	Miss Littie Deal	Lenoir.
Camden	Mrs. J. B. Anderson	Camden.
Carteret	Mrs. H. F. Pridgen	Newport.
Caswell	Miss Bessie Thompson	Leasburg.
Semora	Mrs. Geo. Lansdell	Semora.
Chatham	Mrs. D. L. Webster	Siler City.
Cherokee	Mrs. Geo. Walker	Andrews.
Ranger	Mrs. B. L. Fox	Ranger.
Murphy	Mrs. C. A. Brown	Murphy.
Clay	Mrs. G. M. Cherry	Hayesville.
Brasstown	Miss Cenie Clayton	Brasstown.
Cleveland	Mrs. W. H. Crowder	Lattimore.
Columbus	Mrs. L. C. White	Vineland.
Old Dock	Miss Ethel Snow	Old Dock.
Mt. Tabor	Mrs. Viola Carmichael	Mt. Tabor.
Chowan	Mrs. Jas. A. Boyce	Edenton.
Craven	Miss Reba Morton	New Bern, No. 2.
Ernul	Mrs. T. J. Eaton	Vanceboro.
Cumberland:		
King Hiram	Miss P. M. Pool	Hope Mills.

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CHAIRMEN WOMEN'S IBSTITUTE COMMITTEES—Continued.

Currituck:		
Coinjock	Miss Nettie Overton	Coinjock.
Newbern's Landing	Mrs. J. M. Newbern	Jarvisburg.
Davidson:		
Clarksburg	Mrs. M. M. A. Baker	Thomasville.
Enterprise	Mrs. M. E. Mock	Enterprise.
Cedar Springs	Mrs. J. R. Crouse	Cid.
Boston S. H.	Mrs. B. E. Payne	Thomasville.
Davie	Mrs. J. B. Tabor	Farmington.
Center Church	Mrs. W. A. Griffin	Mocksville.
Duplin	Mrs. Jas. Albritton	Calypso.
Concord S. H.	Mrs. S. W. Newkirk	Magnolia.
Durham:		
Mineral Springs	Mrs. Tom Hicks	Gorman.
Lowe's Grove	Miss Carrie Green	Durham.
Bahama	Mrs. J. W. Winstead	Bahama.
Edgecombe	Mrs. B. F. Shelton	Speed.
Forsyth:		
Clemmons	Mrs. T. W. Griffith	Clemmons.
Belew's Creek	Mrs. Essie Strader	Walnut Cove.
Burke's Grove	Mrs. H. W. Johnson	Winston-Salem, No. 1.
Cold Spring	Mrs. C. E. Everett	Winston-Salem, No. 6.
Franklin	Miss Mary Arrington	Louisburg.
Gaston	Mrs. Lilly Kiser	Crouse.
Gates	Miss Bettie Harrell	Eure.
Granville	Mrs. J. H. Perry	Creedmoor.
Stovall	Mrs. I. Green	Stovall.
Guilford:		
Battleground	Mrs. J. L. Hawkins	Brown Summit.
Colfax	Miss Mattie Gibbons	Colfax.
Pleasant Garden	Mrs. Frank Foust	Pleasant Garden.
McLeansville	Mrs. W. S. Dick	McLeansville.
Jamestown	Mrs. Emma Horney	Jamestown.
Halifax	Mrs. Enoch Simmons	Scotland Neck.
Aurelian Springs	Mrs. J. R. Patterson	Littleton.
Haywood	Mrs. J. H. Plott	Canton.
Rock Springs	Mrs. A. J. McCracken	Clyde.
Waynesville	Miss Mary Davis	Waynesville.
Henderson	Mrs. J. P. Fletcher	Fletcher.
Liberty	Mrs Nannie Worley	Hendersonville.
Mills River	Mrs. Frank Cathey	Fletcher.
Dana	Mrs. R. H. Scadin	Dana.
Hertford	Mrs. J. C. Scarborough	Winton.
Ahoskie	Mrs. B. E. Copeland	Ahoskie.
Hoke	Mrs. T. B. Upchurch	Raeford.
Hyde	Miss Susan A. Braddy	Scranton.
Iredell:		
Cool Spring	Miss Mabel Swan	Elmwood.
Eupeptic Springs	Mrs. R. L. Alexander	Harmony.
Mooresville	Mrs. C. V. Alexander	Mooresville.
Jackson	Mrs. A. C. Reynolds	Cullowhee.
Jones	Mrs. G. R. Hughes	Pollocksville.
Johnston:		
Pleasant Hill	Mrs. J. W. Creech	Benson.
Sandy Grove	Mrs. Herman Blackman	Beasley.
Micro	Mrs. Maxwell	Micro.
Lenoir	Mrs. Bessie Vick	Grifton.
Lincoln:		
Iron Station	Mrs. S. N. Brown	Iron Station.
Reepsville	Mrs. L. S. Kiser	Reepsville.
McDowell	Mrs. Chas. Burgin	Old Fort.
Macon	Mrs. Geo. Bidwell	Franklin.

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CHAIRMEN WOMEN'S INSTITUTE COMMITTEES—Continued.

Macon:		
Maxwell School	Mrs. T. M. Slagle	Franklin.
Otto	Mrs. Chas. McClure	Franklin.
West Mills	Miss Nannie West	West Mills.
Higdonville	Miss Sallie Gray	Cullasaja.
Madison	Mrs. R. L. Runion	Mars Hill.
Marshall	Miss Ollie Hendricks	Marshall.
Martin	Mrs. T. W. Davenport	Oak City.
Mecklenburg:		
Huntersville	Mrs. R. E. Henderson	Huntersville.
Carolina Academy	Mrs. Badger Bryant	Matthews.
Bains Academy	Mrs. Thos. Mann	Matthews.
Mitchell	Mrs. M. J. Bowditch	Toecane.
Montgomery	Mrs. Claudius Dockery	Troy.
Candor	Mrs. O. W. Burkhead	Candor.
Star	Mrs. Jonah Leech	Star.
Mt. Gilead	Mrs. L. P. Bird	Mt. Gilead.
Moore:		
Bethlehem Church	Miss Cecil Seawell	Carthage.
Glendon	Mrs. M. E. Maness	Glendon.
Cameron	Mrs. H. P. McPherson	
Aberdeen	Miss Mary Page	
West End	Miss Mary VonCannon	West End.
Big Oak	Miss Blanche McKinnon	Biscoe.
Nash:		
Stanhope S. H.	Mrs. Robt. Ricks	Stanhope.
Battleboro	Mrs. T. E. Powell	Whitakers.
New Hanover	Mrs. E. T Herring	Wilmington.
Northampton	Miss Luella Brown	George.
Conway	Mrs. Chas. J. Garris	Conway.
Lasker	Mrs. J. S. Rose	Lasker.
Onslow	Miss Macy Weeks	Richlands.
Harris Creek	Miss Elva Walton	Jacksonville.
Orange	Mrs. A. H. Rimer	Hillsboro.
Pamlico	Mrs. G. T. Farnell	Bayboro.
Pasquotank	Mrs. R. N. Morgan	Elizabeth City.
Salem	Mrs. S. J. Parsons	Weeksville.
Pender	Mrs. J. Carvin	Atkinson.
Burgaw	Mrs. D. W. Murray	Burgaw.
Willard	Miss Bettie Hall	Rose Hill.
Watha	Mrs. L. B. Saunders	Watha.
Person	Mrs. Ella Winstead	Woodsdale.
Pitt:		
Grimesland	Mrs. C. M. Jones	Grimesland.
Grifton	Mrs. M. L. Worthington	Grifton.
Polk	Mrs. Saml. Edwards	Tryon.
Randolph:		
Pleasant Ridge	Mrs. C. E. Macon	Ramseur.
Liberty	Miss Ida Williams	Liberty.
Seagrove	Mrs. D. A. Cornelison	Seagrove.
Farmer	Mrs. Frances Hubbard	Farmer.
Richmond	Mrs. J. O. Ellerbe	Rockingham.
Ellerbe	Mrs. E. L. Pegram	Ellerbe.
Robeson:		
Antioch	Mrs. L. B. Skipper	Red Springs.
Lumber Bridge	Mrs. L. C. Hubbard	Lumber Bridge.
St. Paul	Mrs. J. C. Blanchard	St. Paul.
Fairmont	Mrs. E. B. Hayes	Fairmont.
Rockingham:		
Ruffin	Mrs. J. L. Williams	Pelham.
New Bethel	Mrs. John Wilson	Madison.
Stoneville	Mrs. Wm. A. Roberts	Stoneville.

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CHAIRMEN WOMEN'S INSTITUTE COMMITTEES—Continued.

Rowan:		
Rockwell	Mrs. M. J. Cline	Gold Hill.
China Grove	Mrs. Robt. Grey	China Hrove.
Mt. Ulla	Miss Nannie Hart	Mooresville.
Liberty S. H	Mrs. N. J. Goodman	Gold Hill.
Rutherford	Mrs. L. E. Rollins	Rutherfordton.
Ellenboro	Miss Ida Green	Ellenboro.
Sampson:		
Newton Grove	Mrs. Geo. Warren	Newton Grove.
Piney Green	Mrs. A. P. Howard	Salemburg.
Garland	Mrs. J. D. Johnson	Garland.
Harrells Store	Mrs. J. C. Melvin	Kerr.
Beulah	Miss Elizabeth Hobbs	Clinton.
Scotland	Mrs. J. T. John	John Station.
Stanly	Mrs. M. J. Lyerly	Richfield.
Endy S. H	Mrs. Eliza J. Kelly	Big Lick.
Norwood	Mrs. J. C. Dunlap	Norwood.
Stokes:		
Walnut Cove	Mrs. Mildred Alley	Germanton.
Danbury	Miss Lizzie Adkins	Red Shoals.
Surry:		
Pilot Mountain	Mrs. R. E. L. Flippin	Pinnacle.
Piney Grove	Miss Olivia Jackson	White Plains.
Swain	Miss Emma Smiley	Bryson City.
Transylvania	Mrs. G. T. Glazener	Brevard.
Blantyre	Miss Susan Smith	Blantyre.
Tyrrell	Mrs. H. T. Davenport	Columbia.
Union:		
Marshville	Mrs. J. Z. Green	Marshville.
Marvin	Miss Annie Ezzell	Waxhaw.
Waxhaw	Mrs. H. A. Helms	Mineral Springs.
Indian Trail	Mrs. J. A. Crowell	Indian Trail.
Vance	Miss Mary Burwell	Kittrell.
Wake	Mrs. John Broughton	Zebulon.
Warren	Mrs. F. P. Bowden	Manson.
Washington	Mrs. J. W. Starr	Creswell.
Wayne:		
Seven Springs	Mrs. C. W. Ivy	Seven Springs.
Memorial Church	Mrs. Florence Hooks	Fremont.
Falling Creek	Mrs. E. A. Stevens	Goldsboro, No. 4.
Smith's Chapel	Mrs. Mary Woodburn	Mt. Olive.
Wilkes:		
Clingman S. H	Miss Nettie Calloway	Ronda.
Millers Creek	Mrs. M. F. Bumgarner	Wilkesboro.
Beaver Creek	Miss Beulah Ferguson	Ferguson.
Boomer	Mrs. J. H. Eller	Boomer.
New Hope	Miss Sallie Tevepaugh	Gilreath.
Wilson	Mrs. B. J. Thompson	Stantonsburg.
Rock Ridge	Miss Annie Boyette	Wilson.
Yadkin	Mrs. J. W. Reece	Booneville.
Hamptonville	Mrs. Lula Angell	Hamptonville.
Yancey:		
Bald Creek	Mrs. W. J. Waycaster	Bald Creek.
Daybook	Mrs. Alice Renfrow	Toledo.

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ATTENDANCE AT FARMERS' INSTITUTES.

County	Date	Place	Attendance		
			Men	Women	Total
Alamance	Aug. 17	Elon College	140	147	287
	Aug. 18	Maysville	275	190	465
	Aug. 19	Spring Graded School	284	146	430
	Aug. 20	Hawfield	143	98	241
Alexander	July 31	Taylorsville	127	5	132
Alleghany	Sept. 14	Glade Valley	50	25	75
	Sept. 15	Sparta	60	44	104
	Sept. 16	Whitehead	60	87	147
Anson	Aug. 8	McFarlan	315	255	570
	Aug. 11	Polkton	126	247	373
	Aug. 12	Wadesboro	106	84	190
	Aug. 20	Ansonville	165	326	491
Ashe	Sept. 17	Scottville	50	7	57
	Sept. 18	Grassy Creek	120	84	204
	Sept. 19	Jefferson	50	28	78
Avery	Sept. 22	Banners Elk	40	176	216
Beaufort	Jan. 19	Bath	46	28	74
	Jan. 20	Aurora	80	66	146
	Jan. 21	Washington	40	8	48
	Jan. 24	Pantego	25	25	50
	Oct. 27–28	Bath	115	200	315
Bertie	Feb. 16	Mars Hill	55	71	126
	Feb. 17	Windsor	22	10	32
Bladen	Jan. 22	Tarheel	128	36	164
Brunswick	Feb. 3	Winnabow	74	25	99
	Feb. 4	Mt. Pisgah	84	65	149
	Feb. 6	Ash	65	43	108
	April 30	Southport	22		22
Buncombe	Sept. 1	Swannanoa	170	58	228
	Sept. 30	Sand Hill	115	45	160
Burke	Aug. 5	Hildebran	120	110	230
	Aug. 6	Hickory Grove	141	90	231
Cabarrus	Aug. 11	Rimer	275	198	473
	Aug. 12	Concord	120	10	130
Caldwell	Aug. 3	Collettsville	130	34	164
	Aug. 4	Hudson	217	88	305
Camden	Jan. 21	Camden C. H.	40	35	75
Carteret	Feb. 10	Newport	136	110	246
Caswell	July 29	Leasburg	65	50	115
	July 30	Semora	145	165	310
Catawba	Aug. 14	Cloningers Farm	75	50	125
	Aug. 15	Rockett S. H.	50	30	80
	Aug. 17	Catawba	3	1	4
	Aug. 18	Ferrells S. H.	100	50	150
	Aug. 19	St. James S. H.	40	25	65
	Aug. 20	Shuford's Farm	300	200	500
	Aug. 21	Providence S. H.	65	45	110
	Aug. 22	Killian S. H.	150	100	250
	Aug. 29	Minerva S. H.	150	100	250
Chatham	July 24	Siler City	179	155	334
Cherokee	Sept. 15	Ranger	48	29	77
	Sept. 18	Murphy	33	27	60
	Sept. 19	Andrews	39	40	79
Chowan	Jan. 29	Edenton	36	24	60
Clay	Sept. 16	Brasstown	24	3	27
	Sept. 17	Hayesville	72	92	164

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ATTENDANCE AT FARMERS' INSTITUTES—Continued.

County	Date	Place	Attendance		
			Men	Women	Total
Cleveland	Aug. 11	Casar	176	41	217
	Aug. 12	Belwood	185	154	339
	Aug. 13	Shelby	132	38	170
	Aug. 15	Waco	199	146	345
Columbus	Feb. 7	Old Dock	137	70	207
	Feb. 9	Whiteville	81	118	199
	Feb. 10	Chadbourn	53	55	108
	Feb. 11	Tabor	76	51	131
Craven	Feb. 6	Beech Grove	96	86	182
	Feb. 7	Ernul	126	40	166
Cumberland	Jan. 21	King Hiram S. H.	110	110	220
	Jan. 24	Stedman	52		52
Currituck	Feb. 2	Coinjock	80	55	135
	Feb. 3	Newbern's Landing	30	55	85
Davidson	July 24	Enterprise	82	75	157
	Aug. 1	Boston S. H.	165	145	310
	Aug. 5	Cedar Springs	85	88	173
	Aug. 6	Clarksburg	90	33	123
Davie	July 27	Farmington	105	83	188
	July 28	Center Church	115	97	212
Duplin	Jan. 30	Calypso	275	155	430
	Feb. 2	Concord	147	90	237
Durham	July 25	Mineral Springs	215	199	414
	July 27	Lowe's Grove	180	199	379
	Aug. 21	Bahama	275	75	350
Edgecombe	April	Dixie H. S.	250	270	520
	Jan. 19	Battleboro	104	44	148
Forsyth	July 25	Clemmons	210	164	374
	Aug. 15	Belew's Creek	230	240	470
	Aug. 19	Burke's Grove	155	440	595
	Aug. 20	Cold Springs	80	370	450
Franklin	Feb. 25	Louisburg	72	32	104
Gaston	Aug. 17	Sunnyside S. H.	185	200	385
	Aug. 18	Eakers S. H.	250	230	480
	Aug. 21	Stanley	100	128	228
Gates	Feb. 9	Eure	160	147	307
Granville	Feb. 27	Stovall	46	16	62
	Feb. 28	Creedmoor	44	33	77
Guilford	July 29	Pleasant Garden	125	98	222
	July 30	McLeansburg	202	196	398
	July 31	Jamestown	86	74	160
	Aug. 1	Battleground	165	250	415
	Aug. 21	Colfax	85	180	265
Halifax	Jan. 21	Scotland Neck	60	550	610
	Feb. 23	Aurelian Springs	158	210	368
Harnett	Feb. 17	Duke	110	56	166
Haywood	Sept. 10	Bethel	90	48	138
	Sept. 11	Rock Sptings	65	30	95
	Sept. 12	Waynesville	28	16	44
Henderson	Sept. 2	Liberty S. H.	75	88	163
	Sept. 5	Mills River	73	129	212
	Sept. 8	Dana	32	49	81
	Sept. 9	Fletcher	23	52	75
Hertford	Feb. 10	Winton	5	14	19
	Feb. 11	Murfreesboro	85	75	160
	Feb. 18	Ahoskie	55	87	142
Hoke	July 29	Raeford	330	310	640

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ATTENDANCE AT FARMERS' INSTITUTES—Continued.

County	Date	Place	Attendance		
			Men	Women	Total
Hyde	Jan. 22	Swan Quarter	108	60	168
	Jan. 23	Sladesville	70	95	165
Iredell	July 29	Cool Springs	100	85	185
	July 30	Eupeptic Springs	245	238	483
	Aug. 1	Test Farm	1,000	800	1,800
	Aug. 14	Mooresville	350	147	497
Jackson	Sept. 26	Cullowhee	160	72	232
Johnston	Jan. 15	Pleasant Hill	107	60	167
	Jan. 15	Micro	125	118	243
	Jan. 16	Sandy Grove	41	6	47
Jones	Feb. 5	Pollocksville	185	150	335
Lee	Oct. 9	Broadway	50	28	78
	Oct. 10	Sanford	80	41	121
Lenoir	Jan. 24	LaGrange	63		63
	Feb. 11	Kinston	51	2	53
Lincoln	Aug. 19	Reepsville	135	85	220
	Aug. 20	Lincolnton	85	45	130
Macon	Sept. 21	Franklin	53	9	62
	Sept. 22	Maxwell	30	29	59
	Sept. 23	Otto	50	60	110
	Sept. 24	West Hill	90	108	198
	Sept. 25	Higdonville	106	65	171
Madison	Sept. 28	Marshall	225	210	435
	Sept. 29	Mars Hill	115	45	160
McDowell	Aug. 7	Marion	128	31	159
Martin	Jan. 22	Oak City	73	90	163
	Feb. 7	Williamston	45	2	47
	June 4	Parmele (Colored)	50	40	90
Mecklenburg	Aug. 13	Huntersville	275	73	348
	Aug. 17	Carolina Academy	325	373	698
	Aug. 18	Mint Hill	156	190	346
	March 6	Biddle University (Col.)	245	160	405
	Sept. 4	Biddle University (Col.)	120	130	250
Mitchell	Aug. 12	Bakersville	183	27	210
	Aug. 13	Spruce Pine	65	95	160
Montgomery	Aug. 1	Candor	222	158	380
	Aug. 4	Star	175	410	585
	Aug. 5	Troy	200	144	344
	Aug. 6	Mt. Gilead	228	389	617
Moore	July 24	Bethlehem Church	137	146	283
	July 25	Glendon	105	149	254
	July 27	Cameron	114	300	414
	July 28	Aberdeen	113	316	429
	July 30	West End	265	221	486
	July 31	Big Oak	110	61	171
Nash	Jan. 15	Stanhope	97	115	212
	Jan. 16	Nashville	42	20	62
New Hanover	Jan. 31	Wrightsboro	35	33	68
Northampton	Feb. 12	Conway	200	127	327
	Feb. 13	Lasker	70	18	88
	Feb. 14	Rich Square	75	22	97
Onslow	Feb. 4	Harris Creek S. H.	201	145	346
	Feb. 12	Richlands	180	255	435
Orange	Aug. 22	Hillsboro	125	26	151
Pamlico	Feb. 9	Bayboro	109	106	215
Pasquotank	Feb. 4	Elisabeth City	31	30	61
	Feb. 5	Salem	75	63	138

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ATTENDANCE AT FARMERS' INSTITUTES—Continued.

County	Date	Place	Attendance		
			Men	Women	Total
Pender	Jan. 29	Atkinson	100	75	175
	Feb. 2	Burgaw	115	143	258
	Feb. 3	Willard	207	129	336
	March 17–18	Watha	231	278	509
	Nov. 4–5	Watha	155	200	355
Perquimans	Jan. 30	Hertford	22		22
Person	July 28	Chub Lake	500	700	1,200
Pitt	Jan. 17	Grimesland	5	45	50
	Jan. 23	Grifton	52	85	137
	Feb. 14	Greenville	150		150
Polk	Sept. 7	Columbus	115	79	194
Randolph	July 25	Pleasant Ridge	295	295	590
	July 27	Liberty	117	167	284
	July 28	Providence S. H.	52	51	103
	Aug. 3	Seagrove	69	33	102
	Aug. 4	Farmer	150	148	298
Richmond	Aug. 3	Ellerbe Springs	202	205	407
	Aug. 10	Rockingham	74	72	146
Robeson	Jan. 19	Antioch	56	82	138
	Jan. 20	Lumber Bridge	67	53	120
	Jan. 23	St. Pauls	58	35	93
	Feb. 12	Fairmont	32	119	151
	Oct. 17	Back Swamp	125	75	200
Rockingham	July 31	Ruffin	85	85	170
	Aug. 13	New Bethel Academy	110	196	306
	Aug. 14	Stoneville	110	190	300
Rowan	Aug. 10	China Grove	400	375	775
	Aug. 15	Mt. Ulla	225	150	375
	Aug. 21	Liberty S. H.	145	136	281
	Aug. 22	Woodleaf	250	250	500
Rutherford	Aug. 8	Forest City	120	17	137
	Aug. 10	Golden	140	80	220
	Aug. 14	Dobbin's S. H.	225	262	487
Sampson	Jan. 17	Newton Grove	48	10	58
	Jan. 26	Piney Green	169	181	350
	Jan. 27	Garland	86	58	144
	Jan. 28	Harrell's Store	102	140	242
	Jan. 31	Beulah S. H.	185	186	371
	March	Clinton (Colored)	125	100	225
Stanly	Aug. 6	Endy S. H.	145	130	275
	Aug. 7	Richfield	155	118	273
	Aug. 7	Norwood	112	87	199
Stokes	Aug. 11	Walnut Cove	110	225	335
	Aug. 12	Danbury	95	240	335
Surry	Aug. 17	Piney Grove Church	215	245	460
	Aug. 18	Pilot Mountain	300	300	600
Swain	Sept. 14	Bryson City	116	47	163
Transylvania	Sept. 3	Selica	8	24	32
	Sept. 4	Blantyre	48	36	84
Tyrrell	Jan. 27	Columbia	75	24	99
Union	Aug. 13	Marshville	318	137	455
	Aug. 14	Marvin	407	203	610
	Aug. 15	Waxhaw	175	44	219
	Aug. 19	Indian Trail	85	152	237
Washington	Jan. 28	Creswell	85	48	133
	Feb. 6	Plymouth	73	10	83

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ATTENDANCE AT FARMERS' INSTITUTES—Continued.

County	Date	Place	Attendance		
			Men	Women	Total
Watauga	Sept. 21	Valle Crucis	80	122	202
	Sept. 23	Boone	200	200	400
Wayne	Jan. 26	Seven Springs	149	165	314
	Jan. 27	Memorial Church	170	92	262
	Jan. 28	Falling Creek	135	180	315
	Jan. 29	Smith's Chapel	170	110	280
		Dudley (Colored)	45	37	82
Wilkes	Aug. 3	Millers Creek	130	240	370
	Aug. 4	Beaver Creek	225	370	595
	Aug. 5	Boomer	190	330	520
	Aug. 6	Newhope Church	155	200	355
	Aug. 7	Clingman S. H.	800	1,600	2,400
	Sept. 14	Trap Hill	200	147	347
Wilson	Jan. 16	Stantonsburg	18	46	64
	Jan. 17	Rock Ridge	54	36	90
Yadkin	Aug. 8	Hamptonville	155	165	320
	Aug. 10	Booneville	175	173	348
Yancey	Aug. 8	Burnsville	67	20	87
	Aug. 10	Bald Creek	155	200	355
	Aug. 11	Daybook	140	116	256

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NORMAL INSTITUTE PROGRAMS

FARMERS' NORMAL INSTITUTE.

Raleigh, N. C., January 13 and 14, 1914.

Soil Improvement—

1. Drainage—Messrs. Lynde, Baker.
2. Rotation—Messrs. Newman, Pate.
3. Fall and Winter Plowing—Messrs. Hudson, Newell, McLean.
4. Preparation of Soil—Messrs. Sherwin, McLean, Hudson, Newell.
5. Legumes and Cover Crops—Messrs. Newman, Hudson, McLean.
6. Barn and Green Manures—Messrs. Burgess, Garren.
7. Fertilizers—Messrs. Kilgore, Browne, Williams.
8. Lime—Messrs. Williams, Kilgore, Browne.

Garden and Orchard—Messrs. Hutt, Pillsbury, Shaw, Hill.

Poultry—Messrs. Kerr, Taylor, Ross.

Animal Industry—

Work-stock, Breeding, Care, Feeding—Messrs. Roberts, Gray.
Production of Cheap Pork—Messrs. Gray, Roberts.
Care of Family Cow—Messrs. Eaton, Reed.

Field Crops—

Peanuts—Mr. Browne.
Tobacco—Mr. Moss.
Cotton—Messrs. Newman, McLean.
Corn—Messrs. McLean, Newman, Williams, Hudson.

Insect Pests and Spraying—Mr. Sherman.

WOMEN'S NORMAL INSTITUTE PROGRAM.

Raleigh, N. C., January 13 and 14, 1914.

TUESDAY, JANUARY 13.

10:00 a. m. Kitchen Conveniences—Mrs. Hutt.
Causes of Insanity—Dr. Anderson.
Bread Making—Miss Mahler.

3:00 p. m. Care of the Sick in the Home—Mrs. Hollowell.

Woman's Work—Miss Hudgins.
The Family Cow—Miss Carroll.

WEDNESDAY, JANUARY 14.

10:00 a. m. Care of the Eye—Mr. John E. Ray.
Saving of Steps—Miss Webb.
Care of the Baby—Dr. Carroll.

3:00 p. m. Care of the Teeth—Dr. Horton.
What to Do Till the Doctor Comes—Miss Ward.

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FARMERS' NORMAL INSTITUTE.

Raleigh, N. C., July 21 and 23, 1914.

Soil Improvement—

Principal Soil Types in Piedmont N. C., and Their Plant Food Deficiencies—J. L. Burgess.
Economical Means of Improvement—T. F. Parker.
Fall and Winter Plowing—C. R. Hudson.
Effect of Humus on Crop Yields—T. B. Parker.
Rotation of Crops—M. J. Hendricks.
Pastures for Profit and Soil Improvement—A. L. French.
Green Manures—G. M. Garren.
Barnyard Manures—R. L. Sloan.
Protecting Drainage Systems—R. W. Scott.
Erosion and Its Prevention—C. L. Newman.
Winter Cover Crops—T. B. Parker.

Commercial Fertilizers—

Profitable Use of Commercial Fertilizers—B. W. Kilgore.
Mixing for Special Crops—W. F. Pate.
Profitable Use of Lime—C. B. Williams.

Field Crops—

Cotton Growing—C. L. Newman.
Care of Cotton After Ginning—Thos. Nelson.
Corn Culture in the Sand Hills—T. D. McLean.
Corn Harvesting—J. P. Kerr.
Tobacco Culture and Rotations—J. S. Cuningham.
Tobacco Curing and Marketing—E. G. Moss.
Peanuts—T. E. Browne.
Wheat, Increasing the Yield—M. J. Hendricks.
Oats—G. M. Garren.

Horticulture—

The Apple Industry—W. N. Hutt.
The Vegetable Garden—S. B. Shaw.
Small Fruits—R. G. Hill.

Live Stock—

Beef Cattle for Soil Building—A. L. French.
Producing and Curing Pork—D. T. Gray.
Care of the Family Cow—W. H. Eaton.
The Creamery and the Farmer—A. J. Reed.
Cow Testing—Stanley Combes.
Poultry Feeding and Management—J. P. Kerr.
Feeding Farm Stock—G. A. Roberts.
Cottonseed Meal Poisoning—W. A. Withers.
Diseases of Live Stock—W. G. Chrisman.
Hog Cholera Prevention—F. D. Owen.

Miscellaneous—

Insect Pests to be Combatted—Franklin Sherman.
Controlling Diseases of Field Crops—H. C. Young.
Legume Bacterial Cultures—J. L. Burgess.
Coöperation Among Farmers—W. R. Camp.
Economics Applied to Farming—T. F. Parker.

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WOMEN'S NORMAL INSTITUTE.

Raleigh, N. C., July 21, 22 and 23, 1914.

JULY 21.

10:00 a. m. Home Sanitation—Mrs. Hutt.
Health on the Farm—Mrs. Robinson.
Home-made Yeast—Miss Webb.
Teeth—Dentist.
Food and Dietetics—Miss Parris.
3:00 p. m. Social Life in the Country—Miss Hudgins.
Nourishment of Children—Dr. Carroll.
Child Training—Mrs. Hollowell.

JULY 22.

10:00 a. m. Pin Money on the Farm—Miss Clement.
Home-curing Meat—Miss Jackson.
Care of Milk—Dr. Koonce.
Farm Life for Girls and Its Possibilities—Miss Arey.
Bread Making—Miss Arey.
3:00 p. m. Care of the Eyes—John E. Ray.
Care of the Sick—Trained Nurse.
Combination of Food—Miss Parris.
Bread Demonstration—Miss Mahler.
Training Children of the Present for Men and Women of the Future—Mrs. Robinson.

JULY 23.

10:00 a. m. Preventable Diseases—Dr. Jordan.
Organization—Mrs. Hollowell.
Helpful Hints to Farmers' Wives—Mrs. Hutt.

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PROGRAM

OF THE

TWELFTH ANNUAL

STATE FARMERS' CONVENTION

AND

ROUND-UP INSTITUTE

PULLEN HALL
A. & M. College, West Raleigh, N. C.
August 25, 26 and 27, 1914

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OFFICERS.

PRESIDENT—S. H. HOBBS, Clinton.
FIRST VICE PRESIDENT—A. F. YARBOROUGH, Winston-Salem.
SECOND VICE PRESIDENT—W. R. ALEXANDER, Charlotte.
THIRD VICE PRESIDENT—J. P. KERR, Haw River.
SECRETARY-TREASURER—T. E. BROWNE, West Raleigh.

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PROGRAM.

TUESDAY, AUGUST 25.

10:30 a. m. Greetings—Dr. D. H. Hill.
Welcome to Raleigh—His Excellency, Locke Craig.
Our State—Major W. A. Graham.
11:00 a. m. Address—S. H. Hobbs, President of Convention.
12:00 m. Do Soils Wear Out—Prof. C. L. Newman.
12:30 p. m. How to Bring Up An Old Field—R. W. Scott.
2:00 p. m. Maintaining Soil Fertility:
By Green Manures—C. R. Hudson and T. B. Parker.
By Live Stock—Dan T. Gray and A. L. French.
By Commercial Fertilizer—C. B. Williams.
3:30 p. m. Is There Value in Resting Land—Dr. J. A. Morris.
4:00 p. m. Field Demonstration—Arranged and conducted by Prof. C. L. Newman.
8:00 p. m. Address—Prof. M. L. Fisher, Purdue University, Lafayette, Ind.
8:45 p. m. Address—Prof. L. C. Corbett, Bureau of Plant Industry, Washington, D. C.

WEDNESDAY, AUGUST 26.—LIVE STOCK CONFERENCE.

CONDUCTED BY PROF. DAN T. GRAY.

8:00 a. m. Judging Hogs—Dan T. Gray and L. W. Shook.
8:40 a. m. Judging Beef Cattle—R. S. Curtis and L. W. Shook.
9:20 a. m. Judging Dairy Cattle—A. J. Reed and S. M. Salisbury.
10:00 a. m. Making Permanent Pastures in the Coastal Section—B. F. Shelton, T. B. Parker.
Piedmont Section—F. T. Meacham, Eugene Transou.
Mountain Section—T. L. Gwynn.
11:00 a. m. Temporary Pasture Rotations for the Coastal Section—G. A. Holderness.
Piedmont Section—A. L. French.
Mountain Section—R. W. Collett.
12:00 m. Illustrations of the Value of Permanent and Temporary Pastures—Tait Butler, Editor *Progressive Farmer*.
12:30 p. m. Corn Silage, a Supplement to Pastures—W. F. Ward, Senior Animal Husbandman, Washington, D. C.
2:00 p. m. Raising Our Own Work Animals and Their Economic Importance—E. R. Lloyd, Director Mississippi Experiment Station.
3:00 p. m. Coöperative Buying and Selling of:
Beef Cattle and Sheep—R. S. Curtis.
Dairy Products—W. H. Eaton.
Poultry Products—W. J. Shuford.
Horses—J. C. McNutt.
Hogs—W. F. Ward, Washington, D. C.
4:00 p. m. Judging Horses—J. C. McNutt and S. M. Salisbury.
5:00 p. m. Judging Mules—G. A. Roberts and S. M. Salisbury.
8:00 p. m. "The Education of the Boys and Girls of North Carolina"—Address by Dr. T. P. Harrison.
8:30 p. m. "Improved Methods of Agriculture"—Illustrated address by Mr. D. R. Coker, Hartsville, S. C.

WEDNESDAY, AUGUST 26.

CONFERENCE ON COTTON AND CORN, CONDUCTED BY PROF. C. L. NEWMAN.

9:30 a. m. Varieties Adapted to Different Sections of the State:
Cotton—T. J. W. Broom, Monroe, N. C.
Corn—F. T. Meacham, Statesville, N. C.; J. F. Latham, Jessama, N. C.

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10:45 a. m. Improving Cotton by Seed Selection on the Farm—R. Y. Winters, West Raleigh, N. C.
11:00 a. m. Improving Corn by Seed Selection on the Farm—G. M. Garren, Raleigh, N. C.
11:15 a. m. Rotations for Cotton and Corn in Eastern North Carolina—T. E. Browne, West Raleigh.
11:30 a. m. Rotations for Cotton and Corn in Central North Carolina—R. W. Pou, Elmwood.
11:45 a. m. Rotation for Corn in Western North Carolina—E. L. Perkins, Hendersonville.
General Discussion—T. B. Parker.
12:15 p. m. The Fertilization of Cotton and Corn—C. B. Williams, West Raleigh, N. C.
12:40 p. m. Cover Crops for Cotton and Corn—C. R. Hudson, Raleigh.
2:00 p. m. Preparation for and Cultivation of Cotton and Corn—J. F. Diggs, Rockingham; J. A. Turlington, Salemburg; F. P. Shields, Scotland Neck.
2:45 p. m. What Should the Farmer Do With His Cotton Seed—B. W. Kilgore, T. B. Parker.
3:00 p. m. Some Important Cotton Diseases and Their Control—Prof. H. R. Fulton, West Raleigh, N. C.
3:20 p. m. Control of Insect Enemies:
Cotton—Dr. Franklin Sherman, Raleigh, N. C.
3:40 p. m. Control of Insect Enemies:
Corn—Prof. Z. P. Metcalf, West Raleigh, N. C.

WEDNESDAY, AUGUST 26.

CONFERENCE ON HORTICULTURE, CONDUCTED BY PROF. J. P. PILLSBURY.

8:00 a. m. "Morning Demonstration"—Inspection of Horticultural Grounds, and Seasonal Operations.
9:30 a. m. "The Importance of Good Seed, and How to Get It"—H. G. Hastings, Atlanta, Ga.
10:15 a. m. "The Value of Green Crops in Building Up the Land for Trucking." Speaker to be supplied.
11:00 a. m. "Trucker's Crop Rotations for Maintaining Soil Fertility." Speaker to be supplied.
11:45 a. m. "Labor Saving Implements in Trucking." Speaker to be supplied.
12:30 p. m. "Profitable Truck Crops"—R. D. Paschal, Ridgeway, N. C.
2:00 p. m. "The Net Value of Commercial Fertilizers on the Bearing Orchard"—J. B. Sparger, Mt. Airy, N. C.; Paul C. Lindley, Pomona, N. C.
2:45 p. m. "Spraying, an Orchard Necessity"—J. B. Sparger, Mt. Airy, N. C.
3:15 p. m. "The Value of the Home Market"—R. W. King, Raleigh, N. C.
4:00—6:00. "Evening Demonstration—Inspection of Greenhouse and Horticulture Laboratory, and Exhibit of Vegetable and Fruit Packages and Methods of Packing."

WEDNESDAY, AUGUST 26.

CONFERENCE ON TOBACCO, CONDUCTED BY E. G. MOSS, OXFORD, N. C.

9:30 a. m. Maintenance of Humus Supply in Tobacco Soils—E. H. Matthewson, Reidsville, N. C.
10:00 a. m. Methods of Preparing and Treating Plant Beds—J. J. Laughinghouse, Greenville, N. C.
10:30 a. m. New Methods of Sterilizing Tobacco Plant Beds—A. C. Morgan, Bureau of Plant Industry, Washington, D. C.
11:00 a. m. Fitting the Soil for Tobacco—O. L. Joyner, Greenville, N. C.
11:30 a. m. Economical Fertilization of Tobacco—E. H. Matthewson, Reidsville, N. C.

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12:00 m. Effects of Different Forms of Potash Upon Yield and Quality of Tobacco—E. G. Moss, Oxford.
12:30 p. m. Effects of Different Forms of Nitrogen Upon Yield and Quality of Tobacco—E. H. Matthewson, Reidsville, N. C.
2:00 p. m. Utility of Machine Transplanter—O. L. Joyner, Greenville.
2:30 p. m. Tobacco Insects—A. C. Morgan, Bureau of Plant Industry, Washington, D. C.
3:00 p. m. Harvesting and Curing Tobacco—E. G. Moss, Oxford; E. H. Matthewson, Reidsville.
3:40 p. m. Marketing the Tobacco Crop—O. L. Joyner, Greenville.

WEDNESDAY, AUGUST 26.

CONFERENCE ON SMALL GRAINS AND GRASSES, CONDUCTED BY MR. J. L. BURGESS.

9:30 a. m. The Place of Small Grain in the Crop Rotation—E. D. Weaver, Weaverville, N. C. Discussion by T. B. Parker, Raleigh, N. C.
10:00 a. m. Small Grains Adapted to the Different Parts of the State—G. M. Garren, Raleigh, N. C.; T. D. McLean, Carthage, N. C., and H. K. Foster, Newton, N. C.
10:30 a. m. Development of Varieties of Small Grain for Different Parts of the State—Dr. George Nelson Coffey, Wooster, Ohio. Discussion by J. L. Burgess, Raleigh, N. C.
11:30 a. m. Preparation of the Soil for Small Grains—R. W. Freeman, Salisbury, N. C. Discussion by F. T. Meacham, of Statesville, N. C.
12:30 a. m. Fertilization of Wheat—M. J. Hendrix, Cana, N. C. Discussion by C. B. Williams, Raleigh, N. C.
2:00 p. m. What Shall We Do With Bermuda Grass?—Zeno Moore, Whitakers, N. C. Discussion by C. L. Newman, Raleigh, N. C.
3:00 p. m. Hay and Pasture Mixtures—Dr. W. J. McLendon, Wadesboro, N. C. Discussion by E. D. Weaver, Weaverville, N. C., and Walter Woodard, Wilson, N. C.

THURSDAY, AUGUST 27.

9:00 a. m. General Plan for Community Development Organization—Dr. D. H. Hill.
9:15 a. m. What Community Action May Accomplish Along Health Lines—Dr. W. S. Rankin.
9:30 a. m. Community Action Along Productive Lines, What May be Expected of It—C. R. Hudson.
9:45 a. m. What May be Expected From Community Work Along Educational Lines—Prof. L. C. Brogden.
10:00 a. m. What Community Action Can Do for Social Life and Recreation in the Country—Dr. C. H. Poe.
10:15 a. m. How Standard Cotton Grades Can Benefit the Farmer—W. R. Meadows, Office of Markets, U. S. Department of Agriculture, Washington, D. C.
11:00 a. m. The Case of the Farmer—Judge R. W. Winston.
11:30 a. m. Land and Loan Associations—Hon. J. R. Young, Raleigh, N. C.
12:00 m. Business Meeting, Report of Committees, Election of Officers.

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PROGRAM HOUSEWIVES' CONVENTION.

State Department of Agriculture, August 25 to 27.

MRS. CHARLES MCKIMMON, *President.*
MRS. C. R. HUDSON, *Secretary.*

TUESDAY MORNING, 10:15. HELD IN AUDITORIUM, MEREDITH COLLEGE.

Welcome—Major W. A. Graham, Commissioner of Agriculture.
Talk—Mr. T. B. Parker, Director of Institutes.
How the Woman in the Country Can Establish a City Market—Mrs. Rosalind Redfern.
The Housewife and Her Opportunities—Mrs. Julian Heath, Founder National Housewives' Leagues.
Attractive Packs of Eggs and Butter—Mrs. J. H. Henley.
Demonstration of Canning in Tin and Glass—Team of Canning Club Girls.

TUESDAY AFTERNOON, 3:30. HOME ECONOMICS DEPT., HIGH SCHOOL.

Class in Cooking, conducted by Miss Katharine Parker, of Simmons College, Boston, now of Department of Home Economics, Meredith.
Demonstration—Desserts.

Cooking classes will be held each afternoon at the High School Building and every one is invited to come with her note book and pencil and take these lessons free of any charge.

WEDNESDAY MORNING, 10:15: AUDITORIUM, MEREDITH COLLEGE.

President's Address—Women as Organizers: What the Club Movement Has Meant for Women.
The Housewives' League Movement: Its Birth and Growth—Mrs. Heath.
Sports and Amusements for the Rural People—Miss Emilie McVey, Dean, University of Cincinnati.
Five-Minute Talks by Club Women:
Community Club, Chapel Hill.
Magnolia Club, Wayne County.
Housewives' League, Wilmington.
Model Community Club, Salemburg.
United Farm Women's Clubs.
Canning Clubs.
Woman's Club, Raleigh.
Edgecombe County Betterment Club.

WEDNESDAY AFTERNOON, 3:30. HOME ECONOMICS DEPT., HIGH SCHOOL.

Class in Cooking, conducted by Mrs. W. N. Hutt.
Demonstration—Salads.

WEDNESDAY EVENING, 8:30. AUDITORIUM, MEREDITH COLLEGE.

Musical Recital.
Interesting Moving Picture Films and Lantern Slides.

THURSDAY MORNING, 10:15. AUDITORIUM, MEREDITH COLLEGE.

The Social Direction of Education—Dr. Rankin, State Department of Health.
The Child and the Road—Mr. D. H. Winslow, U. S. Chief Engineer, Road Inspection.
Feeding the Child in Its Second Year—Dr. Delia Dixon-Carroll.
The Object of the Afternoon Meeting—Mrs. Sue V. Hollowell.

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THURSDAY AFTERNOON, 2:30. HOME ECONOMICS DEPT., HIGH SCHOOL.

Conducted by MRS. SUE V. HOLLOWELL.

Demonstration—Proper Preparation Infants' Food.
Comfortable Clothing.
Proper Feeding Bottles.
Simple Remedies for Simple Ailments.

THURSDAY AFTERNOON, 3:30.

Class in Cooking, conducted by Miss Louise Mahler.
Demonstration—Bread and Rolls.

OFFICERS FOR 1915.

MRS. J. G. BOYLIN, PRESIDENT, Wadesboro, N. C.
MISS CARRIE HUDGINS, SECRETARY, Raleigh, N. C.

The Women's Branch of the Farmers' Institutes.

MRS. JOHN W. ROBINSON.

This is or should be the most interesting subject to farm women. Our lives are necessarily more or less isolated, and it is a great pleasure to look forward to our monthly or semi-monthly meetings with our neighbors and talk over better ways of doing things, how our children should be made "better babies," and make plans for the betterment of our homes and community.

The men are doing quite a lot through coöperation, and I am glad that the women begin to realize the need in their work also.

Eighteen months ago the women in our community organized; we have semi-monthly meetings six months in the year, and monthly meetings in the busy seasons. We have programs prepared for one year, varying them as we wish. Each member is asked to help render these programs, and the President or Secretary helps them get the literature necessary to study the different subjects. Health, cooking, care of children, conveniences, gardens, flowers, etc., are some of the subjects. Then we have demonstrations occasionally, comparison of cooking, etc. We give the corn, tomato and poultry clubs all the encouragement possible. The club members' ages are from fourteen to fifty years, and all interested. We have a query box and round table discussions at each meeting. We give ice cream suppers, picnics, old time singings, spelling bees, etc., for amusement and to help us make money for our work.

At our county fair the young people gave an excellent agricultural play—three performances. This was educational, and helped us quite a lot financially. Since we organized we have made $250 for our school, also $100 private subscriptions for our teacher's salary. We now have individual patent desks, nice three-room school building, painted inside and out, piano, kitchen curtains, shades, nice teacher's desk, etc.

Of course we were helped by teachers, men, women, children—all. It takes coöperation all around to make a community better.

All our meetings are held in the school building; we are making this the social center. In the grove we have swings, hammocks and a croquet ground.

Once each month a committee meets with the children and have a social afternoon, serving some light refreshments. We believe that all work and no play makes Jack or anyone else dull.

The South was once noted for its hospitality, but it is fast losing that, I am sorry to say. And it is not that we do not enjoy social life, but we have more work to do and cannot enjoy the social side of life so much. The slaves are gone and we cannot hire help for love or money. One lady said to me some time ago, "Oh, I wish we were back in the good old days of slavery." But not I. What would we do with slaves and the high cost of living? We

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must learn to live in this new South, and the best way is to come together and talk the matter over.

We now have oiled floors, linoleum, iron beds, washing machines, coal, gasoline and electric irons, gasoline engines, fruit canners, oil stoves, fireless cookers, waterworks, and so many things to help us which cost far less than slaves or hired help, and if we study our work, how to do it easier, we will have plenty time for reading, club meetings, church work, etc. And we are caring for our health as well, and will not be old and worn out at forty-five years old, as so many mothers are; often dying just when their children need them most.

We certainly need to study our business, the grandest and noblest work on earth.

Home Making.

CARRIE HUDGINS.

The home is the heart of the farm, and the mother the heart of the home. The girls and women have largely the making of our future, and on them rests the responsibility of their being women of the highest type.

Every woman should form an ideal of a home; not the place, but the character of the home. If love reigns not there, if peace is not a dweller, if charity or contentment are not in the household, then it is no home.

The home is the greatest institution, and through it must come improvement in society; it is the pivot upon which success of the nation depends. Good men and women wield the greatest influences of the day.

The mother is the social organizer in the home, and in order to be able to fill this position she must give herself some time to the preparation it requires. She must have some reading matter, and some time set apart in which to read, that she may be prepared to assist in passing the hours pleasantly when the family meet. She plans her meals by no set rule, neither should she expect to plan her evenings; still they require some thought.

Parents should try to teach their children four fundamental virtues: honesty, reverence, sympathy, and industry. The child is a creature of environment; he needs something besides four walls and a bag of books. Touch the heart and you don't need argument.

If in training children to face the responsibility as citizens it must be the family that furnishes the highest ideal of humanity. To kill the romance of youth is to blight the future; to kill the girl's ideals and dreams may make a good servant or housewife, but she can never have the delicate charms which are woman's right. Drudgery to keep mother from it is ennobling, but acts like March wind upon the youth. Man shall not live by bread alone.

Of course some country girls and boys go to college, but the majority do not. Too many have this worked out of them by the home which looks upon it as foolishness. The girls have been left ignorant of the things which mean much to them: the art of being a home-maker, the ability to sew, cook, and make home attractive. In Europe a girl is supposed to have mastered these arts before going into society. If 'twas so with us learning would be more popular. If the country cannot afford this much time, then it cannot hope to keep the young people on the farm.

Often when our country women are questioned they say, "Yes, we do not want our sons and daughters to stay on the farm. Too much drudgery. The most of the women's work disappears down the throats of the family and seems to yield no returns."

Often our boys and girls are leaving the farm because we have not spent enough time in making the home attractive. The wide-awake boy or girl loves fun and must have it. If the home and community do not look after this they are going to look out for themselves in a way that is not always desirable. Swimming is an amusement that boys and girls always enjoy, and if no safe place is provided by the older people they will find places for themselves. The most of the accidents we hear of are boys going in without permission in some secret, hidden-away places.

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Boys and girls are much alike, and rightly so; the girls love much the same sports, and it is only just and right they should have them. If a girl wishes to get out and romp and play, she is called a tomboy and made to feel she has committed a crime. This should not be so. Why not let her develop as we would the boy?

The schcol is a large factor in development of country life and one of the chief agencies for keeping the youth on the farm. If this is to be done, we must not only make it attractive and remunerative, but we must interest them in their work. This can be done by making the work intelligent, by carrying the every-day life into the school and making it a part of the real work.

The true, the beautiful, the good, are so closely interwoven that we need to develop them together in the growing mind. The child should be taught to cherish the truth because it is the truth; the beautiful because it tends to elevate; the good because righteousness exalteth.

Mothers' Problems.

MRS. HENRY SLAGLE.

If "variety is the spice of life," we have no monotony, no stagnation; but the ever urgent call to duty presses us forward to meet them, and mothers, like every other individual, should have a great master purpose, a purpose to live a life of supreme principle which is so commanding and imperative in its demands for recognition and exercise that there can be no mistaking its call. Any kind of a human being can wish for a thing, but only strong, vigorous minds can do them.

In Phillips Brooks' talks to young people he urges them to be something with all their might; and who needs to follow this admonition more than the mothers who have the God-given responsibility of turning the young minds into channels of usefulness, and getting them to see that there is a purpose and an individuality in each little life. We must care for the mind, and we must care for the heart and the body. The latter is by no means the most important, but we are inclined to dwell on it, and I, as a mother, am going to give some of my experiences and some of others.

We must begin at a very early age or in the early stages of existence to care for these little ones; they must have prenatal care for the best development. Send to the U. S. Department of Labor, Children's Bureau, and get a fine treatise on this. We can make ourselves confident and efficient by studying conditions, diseases, remedies and how to use them. If we know a thing we are confident, and do not go into a panic if some disease develops or some accident occurs, but with our own reason and experience take a simple diagnosis of the trouble. And if we have been a careful discerner of the laws of nature, and therewith developed a hygienic sense, this will enable us to more or less instinctively decide whether it is something we can manage or if the skill of a physician is needed. It is a part of my nature to be deeply interested in all these things, and it has stood me in hand many times in the rearing of my eight children. We must study causes and effects.

But now to begin at the beginning. The first thing when a baby is born get your almost indispensable roll of absorbent cotton; then your boracic acid solution which has been prepared by these proportions: two teaspoonsful of the dry powder to one-half pint water, boiled and put in a clean bottle ready for use. Take a little tab of cotton and saturate with this solution, then clean one little eye by wiping from the nose outward. Throw this in the fire and get another tab of cotton and treat the other eye in the same way. Never use the same cotton for both eyes, as one may be infected and the other not. Now this is a mild, clean disinfectant, but after you have used this get the little box containing two ampules of a one per cent nitrate of silver and get as much as one drop in each eye—more will not be harmful. These little boxes are kept now at all well equipped drug stores and have been prepared by experts. They cost only ten cents, and this will in-

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sure your child against this most common cause of blindness (infant inflamed eyes or ophthalmia neonatorum). Then take a little of this cotton or fine soft cloth and put on the end of your finger and wet in the boracic solution and clean out the baby's mouth. Do this every morning until it is at least four weeks old. You can dilute this solution if you like by putting a little of it in a cup with a few spoonsful of warm water. Use this treatment and your child will never have any mouth troubles. This is a fine gargle for sore throat. Also be sure to clean up the mother's breast with the same.

The child being made comfortable, the next thing will be the feeding. Do not feed anything but a little clear warm water, and put to the breast occasionally about every two hours. If the mother is in a normal condition the nourishment will be there in due time, and if she is not, the physician will advise.

You want to watch for every symptom of indigestion, as that is the cause of most baby ailments. And, mother, study your baby; this is *your* job, and keep at it. Don't be quick to give medicines. A little castor oil is often beneficial and is not harmful. If cold is the trouble, try it.

Teething soon comes on, and many think they must have a dope or a course of patent medicines for their children—but don't. First be careful with the child's diet, and keep on its bowels a flannel abdominal binder; this never allows the bowels to become chilled. You can get the light weight for fat babies summer wear, but let it be wool, and take off everything else if you like.

I will give some things for the diet of the child being weaned that Dr. Delia Dixon-Carroll, of Raleigh, gives as some of the best. First, broths. Get an old chicken, dress, cut up and break every bone in its body, as the bones contain the food for the red corpuscles of the blood. Then put this all to cook in one and one-half or two gallons of water and cook slowly for four or five hours; strain and set to cool; when cool take off most of the oil; heat again and put in small, well sterilized can, and it is ready for use. For making beef or mutton broth, take two pounds of the ribby part, break the bones and treat just as the chicken. Another thing she says is fine, and which only a few mothers know, is cowpeas cooked with meat in a good deal of water for a long time. First strain out and give only the soup with a little cream added to it; later strain the pulp through a fine colander and add to this a little butter or cream, as they are both easily digested and contain the protein that all children need. Rice or oatmeal cooked for several hours in a double boiler with a little cream or butter, and very little if any sugar, make a good meal. Avoid sweets at all times as they ferment in the stomach and cause trouble. All breads given to babies should be twice baked or brown and stale. The Zwiebach biscuit is one of the best ready prepared breads.

All mothers should be careful to not nurse their children too long, as the child at about ten months begins to change and needs something stronger, and the mother's milk begins to deteriorate and take on a poison known as ptomaine. The child will gradually get thin, pale and irritable. The time has come for other things to be given to supply the nourishment needed. This is a call for a knowledge of dietetics and the value of foods.

And the Girls.

LULA M. CASSIDEY.

The clear note that has been sounded throughout the land for rural uplift has aroused every institution for welfare to definite lines of activity looking to standardizing country life. The agricultural, health, and educational forces of the State and nation are striving, each in its individual way, to aid in the solution of the rural problem, and it is very evident that the standards are advancing. Many of the agencies which are busy in the work are dealing with the adult, endeavoring to serve the present generation. This is vital work, and a great evolution along all lines of rural progress is the

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growing result of the strenuous efforts which are being made. However, there is a large per cent of the rural population which can never be reached through these agencies. Many are out of reach because of location; many more are unwilling to change their habits of thinking and living; and some others are incapacitated, either through ignorance or through the influences of peculiar environment.

These facts are especially true of country women who, as a rule, have very little opportunity for contact with the larger movements which set the pace for their town and city sisters. Their visions of life are dwarfed in the outset, very often, by the uncompromising customs and traditions which have circumscribed their lives from early childhood—that period of life when the notions of home and the standards of living are eternally fixed in the minds of the youth, as a rule.

In view of these facts it becomes necessary to reach these conditions through the training of the youth for actual living and a conscious appreciation of the matchless possibilities of rural life by courses in our rural schools along practical lines.

No community, no home, can rise above the standard of its womanhood. The average girl is going to spend the most of her years in home making. What finer thing could be done toward home and community building and standardizing country life than to send these girls out from our schools actually prepared to fill their life missions, giving a full measure of service, and at the same time conserving their physical strength? On every hand we see the tragedy of a woman whose health, happiness, hope and ambitions have been ruthlessly sacrificed upon the altar of ignorance.

What value have Latin, algebra and kindred subjects for a girl in comparison with a course of training which shall lead her to know and practice the laws of hygiene and sanitation; which shall teach her the needs of the human system, the foods which best supply these needs, the best methods for the preparation of these foods for nature's use, the economy of time and effort, the conservation of her own strength and health while performing her duties, and the countless other lessons which are vital in the shaping up of every woman's home and life policy?

The argument of "superior cultural value," which is made in behalf of classical lines of training, weakens by comparison with industrial training when a choice has to be made between the two. True culture grows out of spiritual development and soul expansion even more than from intellectual development. What could conduce more effectively to the mental, physical and spiritual development of a girl than a course of training which fits her for the natural sphere of home, and aims at stimulating the native, womanly traits in her character, and gives her actual skill in performing gracefully and graciously the duties of home making.

What duty, then, lies *next* in the development of an efficient rural school system? What has the rural parent a right to expect from the schools? What is it their duty to demand of the schools?

These questions are finding a solution in a number of rural communities of North Carolina through certain activities which have been set in motion through the combined efforts of their teachers and the organized womanhood of the community. There are springing into existence in many rural schools domestic science classes which are serving in a modest but practical way the purpose for which they were intended—that of preparing the girls for life; and these schools are building gradually toward the only scheme of education which can be permanently efficient and effective in rural progress.

Let us see to providing training along industrial lines in our rural schools in order that, through the schools, the otherwise impossible situations may be influenced to higher standards of living, and the girls may go forth to meet the exigencies of life with a fine vision of the possibilities ahead of them and the training which shall enable them to cope with life's problems intelligently and effectively.

Whenever public sentiment begins to demand this type of rural school the teaching force will prepare to meet the demand. Experiments have demonstrated the feasibility of this line of work in rural schools having three or more teachers, and the time is now at hand to require it as an integral part of the school course.

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Farm Life and Its Possibilities for Girls.

BEULAH AREY.

Sometimes we hear it said "There is no chance on the farm for the girl." The girl has just as good a chance on the farm as she has a mind to make. The thing is to have a purpose in life, something to live for. A person without an object in life, without ambition and destitute of a settled purpose to achieve some definite end, is to be pitied. The girl who lives a listless, lazy life, satisfied with her conditions and with no ambition to do or achieve something higher, knows nothing of pleasure. One of the greatest pleasures of life is to endeavor and to overcome. Work is a blessing; idleness a curse. It is a poetical expression "that life without a plan serves merely as a soil for discontent to thrive on." Some point in view, some fixed object of pursuit, is a spur to the energies. A purpose overcomes difficulties; not with a rush and a shout, but one by one. So set your mark high; no person was ever injured or delayed in life by setting his mark high.

The very first and best thing you can do is to equip yourselves for lives of the greatest possible usefulness. This you owe first to your Creator, who in giving life to anyone gives it with a purpose. You have a life-work to perform which no other can do for you. Next you owe it to those around you. First, and this is the point I am trying to make, is the *home*, then your countrymen.

The Home! Think of what that word carries with it; and do we all realize what embraces a home, the magnitude of the responsibilities which rests upon the shoulders of one who undertakes to make one: No, positively I am sure we do not; and sometimes I am inclined to think we do not want to, and today this, as I see it, is why so many of us live in *houses* instead of *homes*.

Now, girls, this is your chance; your real life-work is to make a home. Be a home-maker, not a home-breaker. Well, you will say, how are we going to do this? I want to tell you that it is not done by chance; it is no "happenstance." The person that thinks if a girl can do nothing else she can make a home, or, as others might put it, "cook and keep house," had better think again. Everybody fully realizes that to be a successful farmer you must be able to do more than drive a mule to the end of a cotton row, pull him around and go back, and I am thankful that our women and girls are waking up to the fact that to be a successful home-maker you must be able to do more than fry meat and sweep the floor.

Why is it when a young girl wishes to become a trained nurse, a stenographer, a music teacher, or any other profession as far as that goes, except home-making, she prepares herself for the work? She spends years and hundreds of dollars in preparation, graduates, gets a "job," teaches until she marries, then the bar drops. She feels that her life-work has been completed instead of just beginning it, and well she might, too, for she made preparation for the former work, the latter followed as a matter of fact, and as a matter of fact this is the seat of the trouble in our homes today. Home-making is not considered a profession and therefore not studied. I hope the time will soon come when every young woman who expects to go into a home of her own will have to prepare herself for making a home, just the same as does the young man to support that home. This is nothing more than fair. It makes no difference whether or not you do your own work; if you cannot do it yourself you cannot direct anyone else. You cannot give out what you do not have yourself. If you cannot make wholesome, nourishing bread, do you suppose for a minute you can tell an ignorant person how? Why is it that labor in the home is such a problem today? Because it has not been handled intelligently and systematically. For my part I do not want any. I much prefer a well planned house equipped with the modern conveniences as my servants. These if handled intelligently will respond intelligently, and you can always depend on them.

Now here is the real problem, and we will have to solve it together. Probably you haven't a well planned house and the modern conveniences to lighten and make pleasant your work, but by keeping still is a pretty poor

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way of getting them. A farmer does not or should not put a new piece of machinery on the farm until he is thoroughly capable of operating it and can get value received, and the same is true of the home, for what good would modern conveniences do if you did not know how to use them? just about as much as your Virgil would when you wanted to mix a cake. There is a solution to every problem, and when our girls study this problem of the home it will be solved to a certain extent, but it must be studied.

Now, some will say that this will cost money; but doesn't it cost money to study Greek, German or Latin? Sure it will cost money, and much valuable time too, but it is well worth the price and will pay bigger dividends than any other way it can possibly be invested. The fact that this is a very effectual way influences your life for higher efficiency, and greater contentment in the rural home makes it invaluable. Now, girls, make up your minds to have a course in home economics; you can get it if you want it bad enough. You will have some difficulties to overcome, but anything that is easily gotten is not always worth having. If you cannot leave home, get some literature and work there till you can. Anyone can obtain the government bulletins for the asking, and they are very valuable if studied carefully. Then there are good books and magazines which cost very little in comparison to what you receive from them. Read more; that is what you need; read anything that looks like a Progressive Farmer or Good Housekeeping magazine. Every one of you should have some practical books relating to your work, and should be continually on the watch for information. When you do not read the same thing happens to your mind as does a once stout and hearty body when it receives no more nourishment. Every minute that is not actively engaged in work be feeding your mind, for as every thread of gold is valuable, so is every minute of time. An hour wasted daily on trifles or in indolence would, if devoted to self-improvement, make an ignorant person wise in a few years.

I wonder how many of you know what a balanced ration is and what it means to a sound body? If a hog, and a horse, and a cow need a balanced ration, why does not a man? Is his welfare not as important as that of these animals named? Look what progress the boys are making in agriculture now. You must not lag behind. I believe in equal—not "suffrage"—but rights in education.

One way in which you can make a start at home right now is to join the girls' canning and poultry clubs; this is an open door for you. Think of the knowledge you gain in agriculture in the study of your plants, and then the experience in canning according to the best instructions, of all the good times you can have with your girl friends during the canning season, and what is better still, look at your profits. I know many girls today who are buying their clothes and helping pay their own way to college with tomato club money, and without it this would be impossible.

Now I have been telling you all the things you ought to do; I want to tell you *one* thing you ought not to do.

You have heard the expression that "all work and no play makes Jack a dull boy." It will make many a dull girl too. Do not neglect having a good time on the farm, and pretty often, too, for time spent in vacation is not lost. I fear the majority of you girls do not take the time for pleasure and relaxation. Of course you will not like the farm if you do nothing but stay at home and work, work, work. You are much better equipped for your household work on common days if you get out and mingle with other girls in some club or social.

Now a few words to the mothers. If you mean to keep your girls in the home with you, you must be their sympathetic companion. When a girl feels that her mother has no sympathy with her aspirations and desires she loses all interest in home life. Encourage her in everything new she attempts. What a world of good a few words of encouragement will do if only given in time. Give her time for recreation, give her good books, magazines and papers to read; not some your grandmother used, but the latest and best that are out. How can you expect the home-making element of a girl's life to develop unless it is fed? Encourage in her the sense of ownership by giving her something of her very own and from which she can re-

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ceive a profit. It is not right that the bright, ambitious girl should be denied all these privileges.

In conclusion, I would like to say that when—and that is fast coming—our girls stay on the farm and in the home *from choice* and are taught that cooking and cleaning are based on scientific truths, dull household routine will be changed into intelligent, interesting exercise, and she will bear a more vital relation to the health and happiness of home and community.

Domestic Science—Its Aims and Ends.

MARIA PARRIS, Oxford College.

The importance of the study of Domestic Science is still held in doubt by many people. This is probably due first, to the fact that very few outside of schools know what work is done in this department, and secondly, because in many homes the science of feeding is an unheard of thing.

Soon after it was seen that Farmers' Institutes were teaching farmers the best and most economical diets for cows, horses, pigs, etc., a few thinking women began to realize that human beings were receiving secondary consideration in this most vital point of food.

Let us first look at some of the arguments against Domestic Science. We often hear that too much time is spent on "fancy cookery" and that the courses are not practical enough. This might have been the case years ago, when it was taught by women who had had no opportunity for study themselves. Now scientific training is required of all teachers, and the greatest stress is laid on what we call plain cooking. However the pupils are made to realize the necessity and possibilities of serving plain foods in attractive and tempting ways.

Extravagance is another fault that seems unjustly applied, for the use of "left overs" is emphasized when possible. For instance, when making grape juice, the skin and pulp that are left are converted into a nice jam or marmalade.

Domestic Science does intend to show the student just how to prepare, in the quickest manner, the most palatable and attractive dish with the material at hand. Instead of serving a soggy boiled Irish potato she learns to cook one so that it will be mealy and appetizing.

She is also shown the different methods of cooking that make foods digestible instead of indigestible. When she puts these methods into practice at home she will vary the monotony of eggs fried in grease for such as soft-boiled, and poached eggs on toast.

Just as farmers have already learned that particular kinds of food are needed for horses and pigs, so the Domestic Science pupil is taught that human beings require certain amounts of different types of food to insure good health and proper nourishment of the body. Along this line a thorough knowledge of the composition and right combinations of food is taught. As a result, fresh fruits and vegetables and good clean milk, that are so necessary in our daily diets, will be seen more often on the table, in the place of heavy meats three times a day. So many women sell the nourishing foods that they have, such as eggs and milk, and then buy tonics for the family.

Along with these things lessons are learned in the care of a house and the necessity of a home built for comfort and convenience, instead of one for show.

A woman that could make the best cake, and one who stayed home and drudged day in and day out, for fear of a newspaper being out of place or a rug not exactly straight, used to be considered the best housekeeper.

Things have changed now, and the woman who has a clean, comfortable home for her family and gives them nourishing food, and still has time for her church and community, is held up as an example for others, and towards making more of this kind Domestic Science strives.

Just as soon as the public realize that good health depends almost entirely on the food we eat, then Domestic Science will be compulsory instead of elective in our schools.

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The Farm as a Home.

A. L. FRENCH.

One night I was driving far from any home and far from any town; and realizing that my little mares had already carried me further that day than they should have been asked to do, I sought a stopping place for the night.

Off to the right of the ridge road I was traveling, down in the center of a charming little valley—along the edge of which I had been traveling for fifteen miles or more—sparkled the bright lights of a farm home, and I turned the little mares in this direction. Do you know that you can judge quite closely many times of the quality of a home, in the country, by the character of the lights at night as seen from a distance? A well illuminated room speaks of good cheer and hospitality, and the lights shining clear and strong off into the night indicate that the window lights are clean and shining.

My apology for intruding at that time of the night was cut short by the good lady of the house with the assertion that they deemed it no intrusion for a stranger to join their family circle for a night, and the kindly look in her eye and the hearty handclasp from the head of the house assured me that I had run accidentally upon the "real thing" in country hospitality.

And as the evening progressed, with music, games, stories, and discussion of the weighty problems connected with living and home-making of that time, the impression grew upon me that I had come upon one more of those pillars upon which our great country has been builded, viz., the country home, where dwell intelligent, patriotic, home-loving, well-to-do people.

As I stepped into the big living room there by the great open fire-place sat the aged grandmother, and in her lap lay a copy of the latest issue of the *Ladies Home Journal*, and—bless her old heart—she had been studying the fashion page. But—and right here I stumbled onto one of the reasons for the well-dressed, well-to-do, look of all the children in that large family—grandma was not studying fashions for her own benefit, but was aiding in planning a new winter suit for the oldest daughter of the house. And a little quiet observation showed me that the material of all the ladies' gowns was of the most substantial sort and had not the home maintained, in the person of the grandmother, wife and eldest daughter, a first-class dressmaking plant, the dressmaking bill of that home would have cut deeply into the revenue from the farm.

The books and papers on the large center-table attracted my attention. There was the *Chicago Advance*, the great "Congregational" church paper of that section, and hovering close to the *Advance* was *The Breeder's Gazette* and *Wallace's Farmer*, and a copy of the new *Saturday Evening Post*—then just starting under the present ownership. The *New York Tribune* spoke to me of the soundness of the politics of the man of the house, and the *Century*, *St. Nicholas*, *Independent*, and *Youth's Companion* of the clean thinking of all the members of the family. Then, of course, along with these high-class papers and magazines we would naturally expect to find Longfellow, Scott, Moore, Tennyson, Shakespeare, and some of the standard works of fiction, and all of them with marks indicating that they were not being kept for show. And in the book cases the standard histories and latest dictionaries told more plainly than could words of the constant mind training of all the members of the family.

One of the young ladies upon being asked if the young folks did not get lonesome at times, living so many miles from town, replied: "Oh, no; we don't have time. All the younger ones go to school and when they return home have certain jobs of work to attend to before supper; then we who stay at home have the housekeeping to look after and the care of the poultry and butter-making devolves upon us also. Then after we have the supper work finished there is the music, and then one night each week our literary society has a meeting at the schoolhouse, and of course we have a party or sleigh-ride now and then. If we had any more to occupy our evenings I don't see how we would find time to do the reading we want to do in order to keep up with the times."

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That is the point: those who spend their time "gabbling" and running about have not sufficient time to commune with the people of big brain power who present their thoughts on paper, and this to my mind is one of the strong reasons why well-to-do farmer folks are pretty clear thinkers, as a class.

As one of the older sons went with me up to the quiet chamber, we stopped a minute at the door of the boys' room, and there the young fellows were buried in woolen blankets, sleeping so bully, with the big windows wide open, allowing for absolutely free circulation of the fresh night air. They had a rule that they should take turns building the fire and shutting the windows in the morning, and I could hear the groans the next morning of the young buck whose turn had come that extra cold morning. My room was—as were all the other rooms I saw—clean and furnished with the plainest, most substantial furnishings; in fact, useless fads were conspicuous by their absence over the entire house.

As we started for the breakfast room in the morning there were only men and boys from the front part of the house; the girls all coming in with the mother from the kitchen, where each had done her part in the preparation of the plain, substantial meal, the cooking of which reflected great credit upon the chief cook and her able assistants.

I had thought to speak of the well cared for lawn; the fine strawberry patch, from which one of the small girls told me they sold enough to pay for all the material used in making the girls' summer gowns; the fine sheep; the great bunch of hogs fattening for market; the carload of steers just being started on full feed; the six splendid Jersey cows that paid the grocery bill of the family; the big tool house full of the best machinery; the comfortable cattle sheds, and the good fences. But my space will not permit of this, and anyway these are the things you would expect to find outside, to match conditions inside the home. What I do want to speak of, though, is the "money crop" of this farm: two thousand bushels of sweet corn for seed, the money from which was not to be touched for farm expenses, but was to go to make the first payment on the adjoining farm that had just been purchased. The oldest son told me of this, and when I looked at him and winked, he nodded his head and blushed.

Increasing Corn Yield Per Acre.

G. M. GARREN.

The average yield of corn in North Carolina ought to be at least just three times what it is. This proposition can be proved by figures and figures never lie. According to the Bureau of Statistics the farmers of North Carolina in 1910 averaged 18.6 bushels of corn per acre. That same year 364 boys of the Boys' Corn Clubs reported with an average yield of 58.7 bushels, *more than three times as much.*

According to the same source of information in 1911 the farmers averaged 18.4 bushels. Two hundred and ninety-four boys reported an average of 67.69 bushels. *More than three times as much.*

Next year, 1912, the farmers averaged 18.2 bushels. Six hundred and thirty-five boys average 62.8. *More than three times as much.*

In 1913 the farmers averaged 20 bushels. Six hundred and seventy boys reported an average yield of 62.4 bushels. *More than three times as much.* "Figures never lie."

Some of the phenomenal yields made by the boys make thought-provoking reading. In 1910 ten of the boys averaged over 130 bushels. Instead of ten one-acre fields, make it one ten-acre field. Ten acres averaging 130 bushels to the acre makes a 1,300 bushel corn crop. "Much heap big corn" from a little land. Five of them averaged 140 bushels. A five-acre field—700 bushels of corn—who can beat it? This is an average of more than seven times that of the general farmer. Next year three averaged over 150 bushels. A three-acre field—450 bushels of corn. It would require almost 25 acres of the average farmer's land to produce as much corn. Which had you rather

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cultivate for the same amount of corn, 3 acres or 25? In 1912 five of the boys averaged over 150 bushels. This is 750 bushels of corn from a five-acre field. Two of them averaged over 175 bushels. Two acres of land—350 bushels of corn. A woman can cultivate that much land. This is great encouragement to the small farmer with only a few acres of land. These yields show that it is possible for him to make more corn on his few acres than the large farmer is making on his many, and with much less labor.

In this connection let it be noted that the largest corn grower among the boys in all this Boys' Corn Club movement, judged by the number of bushels grown on his acre, is a North Carolina boy. He is not receiving in the current agricultural literature credit for this, but he raised the corn just the same. In 1910 Jerry Moore, of Winona, S. C., raised 228.75 bushels of corn on one acre of land, and became the champion boy corn-grower of the whole country. His glory was of short duration. In 1911 Chas. J. Parker, Jr., of Menola, N. C., raised 235.5 bushels on one acre. This yield has not yet been exceeded. In 1913 Walker Lee Dunson, of Alexander City, Ala., raised 232.7 bushels; but this lacks 2.8 bushels of equaling Parker's yield. All these boys grew their corn under the direction of the Boys' Corn Club management; and all the corn was measured by the same rules and under the same restrictions.

These regulations require that the measuring be done by disinterested witnesses of no kinship. When Charles Parker sent in his report, the yield was so large those in charge feared a mistake had been made. So by preconcerted arrangements Mr. O. B. Martin, in charge of the Boys' Corn Club work in the South; Mr. I. O. Schaub, in charge of the boys work in North Carolina; T. Frank Parker and T. J. W. Broome, of the North Carolina Department of Agriculture; T. E. Browne, district farm demonstration agent, and E. N. Clark, land and industrial agent of the Atlantic Coast Line Railway, met at the home of young Parker, remeasured his land, gathered up all the scrap corn on the acre, reweighed the whole pile, and found he had 235.5 bushels. None of the other boys' corn was weighed by so competent disinterested witnesses.

Why is young Parker not given the credit of the championship? Samples of his corn were taken to the laboratory of the State Chemist and dried to 12.21 per cent of moisture, the moisture content of crib dry corn. By this test young Parker had 195.87 bushels. This test was not applied to the corn of any of the other boys. By it Parker lost 16.82 per cent of his corn. This much was only water. Assuming the moisture content of the other boys' corn was the same as that of Chas. Parker's, then by this test Jerry Moore had only 190.28 bushels instead of 228.75. Dunson had only 193.56 instead of 232.7. Because of this extra test doubtless explains why Chas. J. Parker, Jr., has never been accorded the honor so justly due him of being the champion boy corn grower of the South. In the popular mind his yield was 195.87, and not the 235.5 that he must be credited with to put him on an equal footing with the other boys.

Parker grew his corn at a cost of 24 cents a bushel; Jerry Moore at a cost of 42 cents; Dunson at a cost of 20 cents (19.9). Dunson has the championship for low cost of production; Parker for number of bushels grown on one acre. Jerry Moore lost the championship in 1911.

Another thing brought out in this work of the boys is the great productive power of North Carolina land when properly manipulated. Young Parker the first year made only 67.5 bushels on his acre of land. The next year his brother made 126.5 bushels on the same acre. The third year he made his wonderful yield on that same acre. In 1913 Geo. West, Jr., of Lenoir County, made 184 bushels on one acre of land, at a cost of only 19 cents, and won the State-wide prize. He had been improving this land just three years. At the beginning, in his judgment, it would not have produced over 25 bushels.

The State's improved lands do not suffer in comparison with the naturally richer lands of other States. Iowa is the greatest corn-growing State in the Union. In her Boys' Corn Club contest in 1912 the highest yield was 141 bushels; the second 131; the third 128; the fourth 123. In North Carolina that year the highest yield was 188; the second 184; the third 173; the fourth 162. A difference between the two highest yields of 47 bushels in favor of

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North Carolina. The difference between the sums of these four highest yields is 184 bushels in favor of North Carolina.

The reports for 1914 are not yet out. In the agricultural papers it is reported that the highest yield in the Boys' Corn Club contest in Ohio is 143 bushels. Durham County has a boy who made 160.17 bushels in favor of Durham County. Durham has beat the big State of Ohio. All honor to Durham County.

Any farmer in North Carolina who cultivates an acre of land in corn and in a normal season makes less than 60 bushels, ought to resign his job, get his knitting and seek employment as a stenographer.

How We May Increase Our Yields of Wheat.

M. J. HENDRICKS.

North Carolina is not considered a wheat growing State; more than one-half of the State grows little if any wheat at all, yet we do grow a considerable number of acres of wheat, especially in Piedmont North Carolina.

The acreage sown in wheat in 1913 was 605,000. The number of bushels produced was 7,078,000, making the average yield per acre 11.7 bushels. The average price paid for wheat in North Carolina is about $1.00. This would make our 1913 crop of wheat worth $7,078,000. It is true that this is a vast sum of money, but when we consider the cost of production and the average yield per acre, we find that it is not a profitable crop.

The Indiana Experiment Station has figured out that it cost $12.33 to produce an acre of wheat. If this is an accurate statement you can see at once that we are growing wheat at a loss. Twenty years ago the average yield of wheat in the United States was 12.7 bushels per acre. Today our average yield per acre is only 14.7 bushels. We have made some increase in yields, but it has been very slow. Ten years ago North Carolina made an average of 8.5 bushels per acre; now we make 11.7 bushels per acre. Some of our farmers this year have demonstrated that we can grow profitable yields of wheat. On the Holt farm in Davidson County, with a yield of 3,300 bushels, the average for the entire crop was 40.5 bushels; on 22½ acres of the same crop the average was 44.5 bushels. A farmer in Rowan County made 168 bushels on three acres, an average of 56 bushels; while another in Montgomery County made 210 bushels on six acres, an average of 35 bushels.

I would like to impress this fact: on each of these farms mentioned above they have, without a single exception, been growing clover and have supplied the land with plant food and organic matter.

Now, as wheat has become a fixed crop in our rotation, I shall endeavor to offer some suggestions as to how we might increase our yields.

First. By thorough preparation of the seed-bed, sufficient amount of plant food and vegetable matter; the time of preparation and necessary implements to do the work are some of the essentials to greater production.

If we follow a clover sod with wheat or follow corn that has been grown after a clover sod with wheat, it almost guarantees a good yield. If you intend to prepare clovered land for wheat, the results would be far better if you would not take off the first crop of clover unless your land has been brought up until it could afford to do without it. By taking off the first crop and waiting for the second crop to mature it makes it rather late to plow the land. Clover sod (or any land you expect to plow for wheat) should be plowed as early in July as possible, after the sod has matured. Give the land frequent workings up to time of sowing; the disc and section harrow are the best implements to use for these cultivations. Weeds and grass should not be allowed to grow on the land after it has been plowed, as it furnishes a breeding place for the fly and also takes plant food from the land in growing them. It does not require as deep plowing for wheat as it does for corn, say from five to seven inches. If you expect to follow peas or corn with wheat, the best and cheapest preparation is to thoroughly disc the land, that is, if the corn has had clean cultivation. The discing in of the pea vines after they have been rolled or planked down is better than turning them under.

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If we expect to get the work done at the right time we *must* have the necessary implements, viz.: a disc plow, in order that we may plow our land in extremely dry seasons; a disc harrow, a section harrow, roller (that we may pulverize the clods), and a wheat drill.

Second. *We must rotate our crops.* We cannot maintain the fertility of our soil and keep up the humus supply without a system of rotation; neither can we increase our yields without a strict rotation. I shall not attempt to offer any fixed rotation, for every man should work this out for himself. He should be governed by local conditions and the crops he grows, but I will say that any system that does not include a legume is *not* a good system.

A rotation of grain crops is but little better than no rotation. A neighbor of mine sowed the same piece of land in wheat four years in succession. I will give you the result of each year's crop: First year's yield, 33 bushels; second, 22 bushels; third, 12 bushels, and fourth, 7 bushels. Each crop had the same treatment and same fertilization, and the decrease in yield was due solely to continuous cropping with the same thing.

Third. By intelligent use of plant food. I believe we can use fertilizer and make a profit by its use, but we should buy it for the analysis it contains and *not* the brand on the sack. There is no fixed formula that we can recommend for wheat on all kinds of soil. We must be governed by the previous crop, kind of soil, etc. We should also know how much of the different plant foods a given number of bushels of wheat takes from the soil, say 50 or 100 bushels, and supply the plant food in the same proportion. Phosphorus is the principal plant food needed in most of our red soils. If you have been growing peas and clover, you will not likely need any nitrogen. On sandy soil you would need to use some potash also.

Fourth. By sowing good seed, that is, seed that has been well graded and is free from filth. By the use of a grader you can in a few years eliminate all filth. There are several different graders on the market the price of which is within reach of the average farmer. Five or six farmers if conveniently located can coöperate in buying a grader, also drills, etc.

As to time of sowing, it is best to have a killing frost before we begin. Usually it is safe to begin after the 15th of October. The amount of grain to sow per acre will depend on the land, say from 1 to 1 1-2 bushels.

Fifth. Be sure to eradicate all smut, as this will decrease your yield and render the wheat less valuable. You can do this by the formalin treatment. You can get instructions as to its use from the State and United States Bulletins.

Silage Crops for the South.

R. S. CURTIS.

Ordinarily any crop placed in the silo would be enhanced in value for live stock either through the succulence which it would retain or the saving through the silo of the finer and more palatable parts of the feed. It is usually either necessary or desirable, however, to supplement silage with dry roughages. Owing to this fact the uncertainty of siloing certain crops, and the adaptability of these crops for supplementary purposes, a better balanced and more palatable ration can usually be obtained than were all converted into silage.

Experience has shown that corn, sorghum, kafir corn, and the grass crops make better silage than the legumes, although cowpeas make a very good quality of silage, especially when mixed with corn. The cowpea should not be siloed alone. Most legumes when siloed alone undergo a change which makes a bad discoloration and usually an inferior, unpalatable silage. Clover and alfalfa are especially undesirable for the purpose because of these changes.

Generally speaking the legumes and hollow stemmed crops such as oats, rye or timothy are not adapted to silage production owing to the difficulty of excluding the air. While these crops are not entirely barred for silage uses, it is seldom that they are so used. If finely cut and mixed with the crops better adapted to silage purposes, they may be used at times advantageously.

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However, unless a crop can be siloed and preserved with a reasonable degree of certainty, it is better to cure it under ordinary air dry conditions.

A number of experiments and observations have been made to determine the keeping qualities and feeding value of various green plants. With very few exceptions the list of crops which can be successfully preserved or which increases in value by siloing is surprisingly small compared with the varied number of farm crops produced for feeding purposes. This may seem unfortunate, but considering the wide adaptability of corn, except in droughty sections where sorghum and kafir corn are successfully used, it is not so considered. It is not as necessary to perfect a method of siloing all crops as it is to have one succulent feed to administer with other dry roughages not successfully siloed. Live stock relish green, succulent feeds, but all can not be fed in this condition. It would neither be economy nor wise from the standpoint of the health of the animal.

The general introduction of silage in the ration for farm live stock is universally recognized as an important factor by those capable of judging the comparative merits of feeding stuffs for various farm animals. While the practice of siloing crops is not as widespread as it should be, marked evidences of its value among the better educated farmers will materially stimulate the use of some crops prepared in the form of silage. Corn is used for this purpose more largely than any other crop, although under certain climatic and soil conditions other crops are recognized to be of greater importance. Wherever corn is successfully grown this crop takes the lead in silage production. The reasons are threefold: First, a corn crop is palatable to live stock at most any stage or normal growing condition. Second, an acre of corn is easy to harvest, and it will go farther as a feed in the form of silage than when in any other condition. Third, no other crop will make as large a yield of silage per acre as will a corn crop, with the possible exception of sorghum or kafir corn. These facts are substantiated by experiments and the practical experience of live stock farmers. Where other crops have been tried it is usually the result of using for silage a crop which is better adapted to soil or climatic conditions, therefore furnishing a more dependable crop for silage producing purposes.

The following extract from a letter written by Mr. W. F. Ward, of the Bureau of Animal Industry, Washington, D. C., gives the consensus of opinion of silage users throughout the South:

"Corn has proved to be the best crop for silage throughout the Southern States. Sorghum has been used to a certain extent, and has proved to be very desirable for silage, although the feeding value is not as great as that of corn silage. I prefer corn silage with some sorghum mixed with it to straight corn silage, as cattle seem to relish it more. About two-thirds corn and one-third sorghum makes exceedingly good silage. If sorghum is used, the corn can be allowed to get a little more mature before being cut than if the corn is put up alone. In Southern Texas sorghum is quite generally grown for silage, and is planted early in the spring. By so doing they get two crops of sorghum a year for the silo. In Florida and extreme Southern Mississippi Japanese sugar cane has been used very satisfactorily as a silage crop. This year the Enoch Lumber Co., of Fernwood, Miss., has filled twenty silos with various crops, such as corn, sorghum, Japanese sugar cane, mixed sorghum and corn, velvet beans, soy beans and various mixtures of these crops. It will be interesting to note how the cattle relish the various kinds of silage. In Central Texas kafir corn and milo maize are quite generally used as silage crops, and have proved very satisfactory indeed for this purpose."

This information in general furnishes what we must accept as very reasonable proof of the value of various crops for silage uses. In the South corn is becoming an important crop, and with the increase of its growth it will no doubt grow in popularity for silage production purposes.

The main essentials of siloing a crop are, first, keeping qualities; second, palatability; third, quantity; fourth, distribution of the crop for feeding purposes throughout the year; and fifth, cost of preparation and converting into silage. The latter item is one of the chief objections to such crops as soy beans, cowpeas or velvet beans. Aside from their uncertain keeping qualities, they are more expensive to silo than either corn, sorghum or kafir corn.

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This is an important consideration in preparing silage. The only objection to corn for silage is its low protein content. This can be overcome, however, by feeding legumes in connection with it. Some advise the mixing of clovers, cowpeas or alfalfa with the corn when siloing it, but this is not advisable if these feeds can be satisfactorily cured in any other way.

The variety of corn for silage is a matter of soil and climatic conditions. Any good corn produced for the dry corn will make a good silage crop. For beef cattle feeding purposes the writer is strongly in favor of a well eared variety to balance the one-sided nature of cottonseed meal. This in conjunction with the succulence gives the South a ration which it is difficult to duplicate from an economical standpoint.

The sorghum crops are of special importance in the West and South where the rainfall is light or irregular. Both saccharine and non-saccharine sorghums may be made into silage. Their superiority to corn as drought resistant crops makes them more dependable, both in yield and quality. The Kansas Station reports that if sorghums are harvested at the proper maturity, when the seed has hardened, they will make silage less acid and more palatable than that made from corn. Experiments show that there is little difference in the feeding values of these two silages. Mixtures of corn and sorghum have been generally satisfactory. Usually they are mixed half and half by running first a load of corn and then a load of sorghum through the cutter. It has been found that corn too dry for making good silage can be materially improved by adding a little sorghum because of the juice which it contains.

Kafir corn is a drought resistant crop, and in this respect is like the sorghum in substituting corn. It yields about the same amount of silage per acre as sorghum, and like sorghum should be mature before being put into the silo. It was found at the Kansas station that kafir corn ranks next to corn silage as a milk producer. This crop is more largely used in the dry sections of Texas where it makes a good substitute for corn. Some sections of the South are no doubt adapted to a crop with these characteristics. In Texas and Western Kansas the cheapest and most practical manner of storing kafir corn is in the silo. When so preserved the shrinkage is small, and there is no loss from the weather or otherwise unless improperly put in the silo.

Sudan grass has not been tested as a silage crop, although, judging from its palatability and succulence, it would prove excellent for the purpose. A mixture of it with the legume crops would apparently be excellent. Its use as a silage crop, however, will probably be limited, owing to the large yields, the ease of curing the grass and the small amount of waste in feeding it. This latter factor, in conjunction with the preservation of the succulence, is the main reason for siloing a crop. Crops which are otherwise palatable and useful in the dry condition are of greater service in stock feeding than when siloed. This argument applies directly to the clovers and grass crops. The crop which makes the largest yield and retains its succulence and palatability is the crop best adapted to siloing purposes. There seems to be no all-round substitute for corn excepting, perhaps, the sorghums and kafir corns, which can be used either alone or in a mixture.

The practice of storing dry fodder corn in the silo is deserving of consideration in the South. In the West this practice is followed with good results. The green corn is first placed in the silo in the fall, and after this is fed out the dry corn fodder is cut and run into the silo with liberal quantities of water. While the quality and feeding value of corn prepared in this way is not equal to that of regular corn silage, it is much more palatable than the dry corn, and there is considerably less waste in feeding it.

The discussion on silage crops for the South to the writer is not as much a problem of determining the crops best adapted as it is in getting larger quantities of corn silage used on live stock farms, principally those producing beef and dairy cattle. The incentives which are now being offered for corn growing will bring this crop into greater prominence as a silage crop. While the South has drawbacks in curing the leguminous hays and other crops now produced, it is believed that better methods of curing in the air-dry condition will render them of greater service than in the silo. Unless silage undergoes a normal fermentation it becomes a dangerous feed for stock. As before

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stated, the hollow stemmed plants and legumes do not make the same quality of feed as corn or allied plants or as they do when cured as hay. Taken as a whole, corn, sorghum, kafir corn, with possible mixtures of these and other crops at times, possibly the legumes, seem to be the wisest course to follow. There may be objections or criticisms to these statements, but it is believed in general they summarize the silage crop problem for the South.

In general, what would be obtained from a crop cured as hay would be true on a comparative basis when it was prepared as silage. Judging from this the increase in value as a silage crop would in general be in direct proportion to that of other crops.

Feeding Dairy Cattle.

R. L. SLOAN.

BODY MAINTENANCE.

The body of any living organism, whether animal or plant, requires food and drink for its maintenance. Withhold drink from a plant or tree during its active growing period and it will wither the first day. Cease to water and feed your cow or any other animal, man included, and the result will inevitably terminate in death. Such is the penalty nature has fixed for disobedience of her laws and from which there is no appeal.

In nature's laboratory, the body of the animal now under discussion, there is a constant need for new food material to furnish fuel for heat and energy which characterize the living from the dead. Just as water possesses power for turning a water wheel but once, and the supply must be continuous in order to keep the wheel turning, so the food consumed by an animal is soon spent, and to keep the forces of life in motion a new supply must be forthcoming.

This food, after being taken into the body and undergoing digestion, is transformed by some magic power incomprehensible to scientists into sensitive living tissue. This transformation of inert material into living, as do all the other processes of life, calls for the expenditure of energy and heat, which can only be obtained from assimilated food. A part of the energy value of food is consumed chewing, swallowing and digesting that which is eaten, for no organ of the body can be induced to work without pay. The heart must receive pay in advance through energy stored from food previously eaten for every beat which sends the life-sustaining blood into all parts of the body. Likewise the contracting muscles which keep us involuntarily breathing day and night must burn their midnight oil collected from food stored away in the body. The temperature of the blood must be maintained about the same throughout the year (98.6 F. in man) regardless of atmospheric conditions. Add to all of this the energy required for tissue repair when injured, for growth and reproduction. Now if work is to be performed or milk produced or fat added, an additional amount of food must be supplied after providing for all of the above.

Plants take the elements and simple compounds and combine them into substances which we have learned to call carbohydrates, fat, and protein. These same compounds when eaten by an animal, after being taken into its body, are separated, transported and rearranged according to the function of the animal, thus completing another span in the transformation of erstwhile inert matter.

Each class of compounds has a duty to perform in moulding the life of the animal. Protein is necessary to the normal development of the framework—bone, muscle, nerve, blood, hair, hoof and hide. Carbohydrates enter into tissue formation, and greatest of all they form, when burned, the basis of heat and energy for carrying on the work of the body. Fat is a reserve supply of heat and energy stored away, for economy of space, in a more concentrated form than carbohydrates, to be drawn on as needed. If for any reason the fat is withheld from the feed of the animal enough of this compound may be manufactured from protein and carbohydrates to sustain life, or even to add fat to the body. Should the carbohydrates be deficient in the ration energy heat may be obtained to carry on the processes of life from

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the protein and fat, provided, of course, these elements are supplied in sufficient quantities. But if protein is withheld there is nothing to take its place—the animal dies. Or if there is some in the feed but the amount is insufficient while the animal is young the result is a stunted growth and poorly developed animal for life. The explanation of this is that carbohydrates are made up of carbon, hydrogen and oxygen. Fat is also made up of carbon, hydrogen and oxygen, but relatively much more carbon. Protein is made up of nitrogen and sulphur in addition to carbon, hydrogen and oxygen. While the latter three elements are found in all three compounds, and are more or less interchangeable from one to another, nitrogen is only found in the one, and being so essential to life, it must be supplied.

FUNCTION AND FEED OF THE DAIRY COW.

The function of a dairy cow is to convert the energy found in rough feeds into a form at once palatable and digestible to animals that otherwise could not use this energy. In this respect she is like a machine. The coarse, unwieldy product is fed to the cow machine to be manufactured into milk. After exacting her toll for body maintenance and work of changing feed to milk, according to Jordan, about twenty-six per cent of the digestible energy in the feed is returned in milk. He bases his calculations on a typical 870-pound dairy cow producing 20 pounds of milk from 15.5 pounds of digestible feed, with an abundance of water. This factor, however, is exceedingly variable, even aside from digestibility.

A prime requisite for a maximum milk flow is that the cow be full. To this end a bountiful supply of relatively cheap feed should be supplied from forage crops. Chief among the sources for supplying this cheap bulky feed is the corn plant where silos are available for preserving the cut stalks. Silage is preëminently the filler for the spacious stomach of dairy cattle. Corn for silage should not be cut until after the shuck turns brown and the kernels begin to glaze. However it is generally found to be good practice to supplement silage with a small allowance of a good legume hay or, in the absence of this, corn stover or non-leguminous hay may be substituted. There are so many farmers owning only one or two cows who cannot afford a silo that some other roughage must be provided. For North Carolina, cowpea and soy bean hay easily take first rank. The clovers and oats and vetch are also popular feeds. In too many instances cows in this State are forced to subsist, and expected to produce milk, on corn shucks and corn tops, or wheat or oat straw, along with a small allowance of cottonseed meal and hulls.

Thirty pounds of silage and ten pounds of a good hay, along with a reasonable allowance of grain, is about all that the average grade dairy cow in this State can be induced to eat. However, in the economical management of a dairy herd, the aim of the feeder should be to furnish the cows with all the so-called roughage they will consume without leaving any.

Where pasturage is available through the summer months the feeding problem is greatly simplified. Large dairies are usually located near cities where land is so valuable that the owner finds it more profitable to devote his limited acreage to silage corn production than to pasture. There are many dairymen, however, who depend largely on pasture crops for spring and summer feeding, and who improve their pasture land.

In addition to the specially prepared permanent pasture of mixed grasses and clovers, an abundance of rye is sown in the fall for early spring grazing, and the residue turned into the land for soil improvement. Farmers keeping only a few cows for family use generally have either a permanent unimproved pasture or grazing land from which the animals are expected to draw the greater part of their living through the spring and summer months. Exceptional cases are known to the writer where cows have produced a good flow of milk from pasture alone, receiving no grain ration whatever.

Soiling is but little practiced in this State. It has generally proven uneconomic and unsatisfactory to be forced to gather feed every day regardless of weather conditions or other factors. There are a few who still practice this method in a limited way and find it profitable, but this is rarely if ever the case where a silo exists.

For a succulent feed in the fall and winter on farms where there is no

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silo, root crops fill the need admirably. Large yields can be secured of beets, rutabagas, turnips and related crops, all of which make good cow feed when either run through a feed cutter or chopped up by hand enough to prevent the cows from choking on them.

To produce a large amount of rich milk requires usually more nutrients than the cow is able to get from coarse or succulent forage and ordinary pastures. According to the Wolff-Lehmann standard for a 1,000-pound cow yielding 22 pounds of milk daily, an allowance of 29 pounds of dry matter, 2.5 pounds of digestible protein, 13 pounds of digestible carbohydrates, and .5 pound of digestible fat should be daily provided. This ration has a much larger proportion of protein than one recommended for fattening cattle. The nutritive ratio between protein and the energy producers is here 1 to 5.7. Henry's ideal ration for supplying this feed consists of 40 pounds of silage, 15 pounds of clover hay, 3 pounds of ground corn, and 1 pound of cottonseed meal. Here most of the nutrients come from inexpensive but desirable home grown roughage, requiring only four pounds of concentrates to balance the ration.

For North Carolina there is no better carrier of protein than cottonseed meal to be added to the dairy ration. Though dangerous when fed to calves and pigs, or even to cattle in unlimited quantities, there is not only no danger when fed to grown cattle in quantities less than six pounds per animal a day, but for economy, palatability and convenience it is unsurpassed. Rarely is it necessary or good economy, however, to feed more than four pounds of cottonseed meal a day. Linseed meal, Gluten meal, and dried distillers' grains are other feeds shipped into the State for their high protein content.

Dried beet pulp is growing in popular favor among dairymen throughout the State. It invariably increases the milk flow immediately upon being added to the ration, and an appreciable decrease is as quickly noticed on withdrawing it from the ration. This is a feed rich in carbohydrates, poor in protein, and containing no fat. Its cost, owing to scarcity and long distance to factories, renders its use almost prohibitive except under special conditions.

Perhaps the next most popular feed in the State after cottonseed meal is wheat bran. These two at present prices form the basis of nearly all mixtures of concentrates, the bran having a decided lightening effect on the meal. A mixture of equal parts of cottonseed meal, wheat bran, dried distillers' grain and dried beet pulp has given excellent results in the dairy at the North Carolina A. and M. College. For a heavy milker getting rather thin, two to four pounds of corn meal is added to the daily ration until normal flesh is regained.

There is a tendency among dairymen to feed more concentrates or grain than is profitable. The desire seems to be a maximum flow of milk regardless of cost or economy. The fact is where Herd Testing Associations have not been formed the owner experiences difficulty in separating the robber cows from the profitable ones, nor has he generally taken into consideration the cost of production. The simplest rule that can be given is to feed all the roughage the animal will consume and not more than one pound of grain for three pounds of milk produced..

ENVIRONMENT.

The dairy cow responds to kindness. Good feed and good housing may be more than offset by having a dog drive the herd up in the evenings. Unnecessary noise in the barn at milking time may so excite a cow as to materially affect her milk secretion, for, contrary to popular belief, cow's milk is elaborated from the circulatory system largely during the process of milking.

Though other classes of stock, including dry cattle, may stand exposure without apparent injury, such is not the case with milk cows. A severe wind will reduce the milk flow quicker than almost anything else. Good, comfortable quarters are therefore necessary during severe weather in winter for a paying business. Otherwise too much of the feed is consumed in maintaining the normal body temperature.

On account of the large stomach of the cow, feeding oftener than twice a

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day is unnecessary. Regularity, however, should be rigidly observed. Feeding at four o'clock one day and seven the next tends to keep the cow unsettled and nervous. And the order of feeding grain and roughage should be constant too.

Owing to the fact that 87 per cent of milk is water, the cows should have free access to plenty of clean water. Salt should be supplied daily in the feed or else kept constantly in the feed lot in the form of rock-salt, both for the health of the animal and for an inducement to drink more water.

SUMMARY.

Nature requires of all animals that nutrients be consumed for body maintenance, growth and reproduction. This toll must be exacted and other feed added before we should expect milk to be produced or other work performed.

Different classes of nutrients are required for different functions, and in general protein is required for frame-work, in growth and repair, and in work, with a considerable amount consumed in milk production. While carbohydrates and fats are more or less interchangeable in function, the ultimate end of both is to produce energy. Large amounts are also used in milk production.

The dairy cow is a machine for converting coarse feed into milk. Cheap feed in the form of forage plants should be supplied in abundance, and ordinarily not more than one pound of an expensive grain ration should be fed for each three pounds of milk produced.

Environment should not be overlooked in the feeding barn. Reasonable quiet should be observed. The dairy cow should not be exposed to severe weather conditions. Regularity is essential to good feeding. Plenty water and salt should be provided.

Hog Raising Versus Hog Cholera.

DR. F. D. OWEN, U. S. DEPARTMENT OF AGRICULTURE.

There can be no doubt that the present European war has worked vast financial injury to the Southern cotton planter this year. Also there can be no doubt that it contains a valuable lesson, in once more showing the fallacy of the one-crop method of farming, and it has helped to bring into the foreground the adaptability of North Carolina as a stock-raising State, and the need of developing that industry upon our farms.

For several reasons North Carolina enjoys unique advantages which should put her among the first States in the live stock industry, not the least of which is the climate she enjoys, and which permits of pasturing nearly the year around, and her nearness to a ready market for all such products that can be grown. And it is generally conceded that the animal which gives the quickest returns is the hog.

Statistics show us that North Carolina has but 1,335,000 hogs, which is equivalent to only 4.7 hogs per farm. Also it is shown that this State imports from the Northern and Western States annually more than six and one-half millions of dollars worth of cured meats, besides the fresh meats which are brought in; and as cured meats generally mean pork in one of its various forms, it can be readily seen how good a market there is right here at home, in addition to the live stock markets of Richmond, Baltimore, and other cities.

But in order to obtain the full measure of profit to be derived from the hog raising industry, there are a number of items which must be thoroughly understood, among which may be mentioned better housing, better pastures, better feeding, and more attention to the animals generally, for a crop of hogs is not going to be successful and make money for the owner if it is not carefully watched and taken care of, any more than a farmer could expect to make a good crop of cotton or tobacco by simply putting the seed into the ground and then come back several months later to harvest the crop. But the thing above all else to be considered is hog cholera, the greatest of all scourges to the hog raiser.

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Hog cholera is an acute, highly contagious disease, affecting hogs only, and is characterized by a very high death rate (85 per cent); loss of appetite, rapid emaciation or loss of flesh in those animals which do not die within the first week or so of the disease, and the rapidity with which the disease is spread through a neighborhood.

The first reported outbreak of the disease in the United States was in Ohio in 1833, and from that first invasion it has spread until there is not a State or section of this country in which hogs are grown that have not felt the ravages of this disease. It seems to go in epidemics, or waves, over the country, and appears to usually start in the South and East, which can be readily understood to be due to the milder climate and longer period of warm weather. The first serious epidemic passed over this country in the years of 1886-87, and the mortality reached 134 hogs out of every 1,000. For the next few years the mortality subsided until in 1896-97 a second epidemic gathered force and at its climax killed 144 hogs out of each 1,000 in the country, or nearly 14.5 per cent of all the hogs in the United States. Following this outbreak the mortality again declined, going to as low as 45 per 1,000, but in 1911 it again started to climb and reached 89 per 1,000 in that year, and in 1913 had gone to 107 per 1,000.

In 1913 the total number of swine in the United States was given at 61,178,000, and out of that total there were 6,738,283 hogs which died from cholera. North Carolina last year had 1,335,000 hogs and lost 69,687 from the disease, valued at upwards of three-quarters of a million dollars. Thus we see that we are dealing with a disease which, unless controlled, will keep on causing immense financial losses to the farmers who devote their efforts to the raising of swine.

The symptoms of the disease will usually develop in from five to fifteen days after the animal has been exposed to the contagion, the average period being about nine days. And usually the first thing the owner will notice will be that the animals are not eating as they should; they will appear listless, ears and tail droop, and back arched. He may at first be constipated, and will probably later develop diarrhœa; there is usually a discharge from the eyes which at times is profuse enough to cause the lids to gum together. His skin, especially upon his abdomen from the chest to the thighs, will assume a reddish discoloration, and if his temperature is taken it will be found to be much higher than normal, which is from 101.5 to 102. These and other manifestations will prevail for from a couple of days to as long as ten or twelve days, when the animal usually succumbs.

However if the virulence of the virus, or causative agent, is low, or if the resistance of the animal is high, he may linger on for from a couple of weeks to a month or more, and then it has assumed the chronic type of disease. In these cases the animal will gradually wither away until he is scarcely more than an animated skeleton, and it would be much better if such cases were destroyed at once for it will take months of patient feeding and nourishing to bring him back to thriftiness, and all the time he is sick he is a constant source of danger to other animals in spreading the disease about the neighborhood, or maintaining the causative agent upon the farm where he is confined.

The disease presents a train of symptoms which are far from constant, and so also is the picture a sick animal presents after death. If one were to be slaughtered while at the height of the disease and an examination made one would first look for the reddened skin. The next portion of the body to be examined would be the lymphatic glands or "kernels" of the neck, and which in cholera become enlarged and reddened. After this the lungs would claim attention, they showing numerous blood spots over their surface which cannot be washed off with water, thus showing them to be underneath the pleura covering the lungs. The stomach would next be examined, and upon its inner side, in a case of cholera, we find the lining to have become covered with small red spots very often. From the stomach we next look at the inner side of the intestine, especially at that point where the small intestine joins the large. Here we look for the typical "button ulcer" of hog cholera, and which may be in size from a pea to as large as a twenty-five-cent piece, and which presents a black, raised surface above the surrounding parts, and has a yellow center. These ulcers are usually found in the chronic

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type of cholera and are considered to be diagnostic of the disease. Probably one of the most important places to look for disease is in the kidney, where we look for a change that has given to it the name of "turkey egg kidney," from its resemblance to this egg. The organ becomes spotted with little hemorrhages which are in size from a pin point to as large as a pea, and lay underneath the capsule of the organ. The bladder should also be examined for changes there, the appearance being little hemorrhages scattered over its inner surface, showing the rupture of minute capillary vessels.

As noted above, not all of these changes may be expected in any one carcass, but the presence of any of them, taken in consideration with the fact that the disease seems to spread with such rapidity, will indicate cholera.

The United States Department of Agriculture, through the Bureau of Animal Industry, has been endeavoring for years to control this disease; as long ago as 1878 Congress appropriated $10,000 and caused a commission of nine men to be appointed to study the disease and ascertain if there was any remedy for it. They worked faithfully and in 1905, Dr. M. Dorsett and Dr. W. B. Niles, with others, produced what has become known as the Dorsett-Niles method of immunization against hog cholera.

It is unnecessary to go into the technical details of how this serum is produced, but it can be stated that before it was recommended to be generally used it was tested upon large numbers of animals, both in the laboratory and in the field upon farms and under ordinary farm conditions and found to be wholly dependable if used in accordance with the very simple directions.

After the method of serum immunization had been perfected to a point where it could be entrusted to the general public, a meeting was called of the officials of the various states and among those which responded was North Carolina; and the results were that a plant to manufacture serum and sell it to the farmers at cost has been established and has been the means of saving many hogs for this state. This serum can be obtained by application to the State Veterinarian, Raleigh, N. C.

There are two methods of using this serum; one is designated as the Serum Alone Method, and consists of injecting a proper amount of the serum into the muscular tissues of the animal to be treated and will result in giving an immunity which will last for from six to eight weeks. This is ample time for an owner to clean up his premises and remove the danger; or he can fatten his hogs in that time and slaughter them or send them to market. This method can be administered by any one and if the ordinary sanitary precautions are observed good results will follow.

The other method consists of injecting a proper amount of serum into one side of the body, and into the other side the injection of a very small and carefully regulated dose of the actual diseased blood obtained from a hog that was slaughtered during the last stages of the disease, and which will result in an immunity of much longer duration, from several months in pigs to practically a life immunity in older swine. But as can be readily seen, this method has to be handled with extreme precautions, and so the State Department of Agriculture has ruled that no one but a competent Veterinarian, or a man who has been specially trained in the handling of this virus shall be permitted to administer the "Serum Simultaneous" method of immunization.

These methods of serum immunization are of great value in helping to save the swine North Carolina now has, but in order to control the disease and to finally eradicate it, we must use something more than serum, and the following "DOES" and "DONTS" will epitomize the most needful things that should be done by the farmer when the disease gets a foothold in his neighborhood or in his herd.

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"IF YOU HAVE CHOLERA UPON YOUR FARM"

"DO"

Notify your neighbors that they may protect themselves.
Post notices of infection upon your gate posts to protect others.
Notify the State Veterinarian that he may help you control the disease.
Burn all dead carcasses and stop the spread of the disease.
Disinfect, remove, and immunize all your well hogs.

"DONT"

Allow sick dogs to run at large; it is against the State laws.
Don't allow strangers to go into your hog lots.
Don't neglect to clean up your farm after an outbreak of cholera.
Don't allow buzzards to hover over or alight upon your farm.
Don't add new hogs to your herd without quarantining them for 30 days.
Don't allow your hogs access to streams and overflows.

And if we can have the help of every one to this extent, the losses from hog cholera can be greatly cut down, and a final eradication of the disease can be hoped for.

Controlling of Crop Diseases.

HARRY C. YOUNG.

It has always been exceedingly difficult to present the subject of plant diseases to farmers. It is a proposition that must come to them from scientists, must be handled by scientists through the coöperation with the crop growers. A farmer is almost helpless before a serious attack of any plant disease and as these diseases work on the plants in a similar manner that diseases work on animals, it seems that his first duty is to consult or depend upon a specialist to solve his problems. The state has in its employment men for this work and all the crop growers need to do is to let their wants be known. How many farmers through lack of knowledge of what plant diseases are and how they work, lose a part or all of their crop which might have been saved had the disease been recognized. The sooner farmers realize that plant diseases exist and are increasing in number, the better plant diseases will be controlled. In the majority of cases the son follows out the ideas of his father. When we talk plant diseases to him he says: "My father could raise good crops and fruit and never heard of plant diseases, why should I spend time and money trying to eradicate something that I scarcely believe exists." He forgets he is living in a different age than that of his father. Diseases have become much more general in recent years, especially since our modern methods of rapid transportation. Our desire for new and imported varieties of seed helps to increase the spread of plant disease. We can notice though that most of the farmers who are making money today use every available means for crop protection. But the sad fact is, the majority of the farmers of North Carolina are not making enough money, the cause of which is largely due to the lack of dependence in experts that are hired to help them, but instead clinging to the ideas of their fathers. To give you some idea of how much the farmers depend upon the specialists secured to help them I wish to cite the following example: In many sections of the state the growers of leguminous crops have been noticing a sort of damping off or wilt in some of their clover fields. This is caused by a fungous disease that is brought into every community along with the clover seed. The fungus forms its spores in small groups surrounded by a heavy wall so that the small body of spores resembles very closely a clover seed. These bodies are sown in the field along with the clover seed and the result is you have introduced a disease that is likely to stay with you as long as you try to grow clover. These little bodies known as sclerotia can only be recognized by specialists. In order to check the present outbreak the State Plant Pathologist sent out a request for every farmer to send in a

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sample of seed that he might determine whether they were suitable for sowing or not. The result was that only one man sent a sample of his clover seed in to be tested. This fall thousands of acres were planted with spores which will be ready to cause the disease next spring, all of which could have been prevented.

Nearly all diseases of the more important crops can be prevented by using a small amount of time and money and a little thought. Take, for instance, the oat smut. The oat crop of North Carolina is diminished from 10 to 40 per cent annually by this disease alone. The cost of producing oats under ordinary conditions is about $9.00 per acre. At the average selling price it would take 22.5 bushels to break even. The average yield for North Carolina is about 20 bushels. Thus you can see the average farmer is growing oats at a loss, not saying anything about the large number who are producing less than the average. Ordinarily, when preventive measures have been taken the crop yield was increased 20 per cent. This increase of 20 per cent over 20 bushels would bring the average yield up to 25 bushels per acre. At this rate the farmer would not only raise oats at cost but would realize a net profit of two and one-half bushels per acre. Oat smut, as a rule, can be almost entirely controlled by treating the seed with formalin in the following way. One pint of formaldehyde to thirty gallons of water will make a solution sufficiently strong to kill all smut spores. There are two ways of applying the formaldehyde solution. The first, and a little the cheapest, is by spraying the seed. The grain should be spread out rather thinly over a smooth surface, such as a barn floor, canvas, or hard ground. The mixture should be sprinkled thoroughly over the grain. Then mix the grain well and heap in a pile. Cover the pile with old carpets, canvas or anything that will prevent the fumes from escaping. The fumes from the formaldehyde are as deadly as the solution itself. Leave the seed covered about six hours and then dry. In the second method the grain is immersed. This can be done by dipping a sack of oats into a barrel containing the same strength of solution as used in the former method. The sack should be left in the barrel about ten minutes. Then drain and put the wet sacks of grain in a pile and cover as in the first method. It should be left covered about two hours. The seeds should then be dried and sown. Formaldehyde costs about thirty cents a pint and one pint will be sufficient to treat 30 bushels of grain. It only takes a thinking man to see that this is a good plan to increase his oat crop at least one-third.

The average yield of cotton is diminished from 10 to 40 per cent by plant diseases. The one causing the greatest amount of loss is anthracnose or boll rot. The spores of cotton anthracnose are disseminated largely through the seed. They can live in the seed at least three years and it is unwise to plant seed after they have attained that age. The spores will remain in the old stems and bolls for twelve months. Therefore, in controlling the disease, there are two important measures. First, practice at least a two year crop rotation. Second, select uninfected seed. Seed should be selected at picking time from bolls that show no signs of infection of any sort. The boll should be large and contain characters needed in improving the variety. The cotton picked in this way should be ginned after all other ginning is done and the gin disinfected. If it is too much trouble to select cotton seed for the entire field, a small amount may be selected and used for starting a seed plot. The proper selection of seed not only controls the anthacnose but improves the variety year by year. No man can afford to raise cotton and not follow out the two methods mentioned above.

Corn suffers less from diseases than does any other crop. Corn smut probably lowers the yield of corn more than any other disease. The only control measures for corn smut are crop rotation and field sanitation. Keep the smutted stalks and ears from getting into the manure. Seed selection always improves corn, yet a very small amount of smut can be gotten rid of in this way.

The potato crop often suffers from diseases that are largely preventable. Probably the most serious disease of the Irish potato, especially in the western part of the state, is the late blight or downy mildew (*Phytophthora infestants*). The disease appears late in July. It affects the stems, leaves, and tubers. Protective spraying with bordeaux mixture will entirely control the

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disease. The first spray should be applied when the potato plant is about six inches tall. Three thorough applications should be given during the months of July, August, and September. A 5-5-50 solution of bordeaux should be used. This means 5 pounds of lime, 5 pounds of bluestone and 50 gallons of water. Bordeaux mixture is prepared as follows: Dissolve 5 pounds of bluestone in 25 gallons of water. The bluestone will dissolve more rapidly if it is suspended near the upper surface of the water. Slake 5 pounds of lime in a small amount of water. After the lime is well slaked add enough water to the paste to make a volume of 25 gallons. Put the two solutions together and you have prepared the best fungicide known. When bordeaux mixture is used for spraying fruit it should be made of 4 pounds of lime, 4 pounds of bluestone, and 50 gallons of water. Bluestone can be bought at any drug store for 8 cents per pound. Bordeaux mixture can be bought already prepared for application.

Almost all diseases of farm crops can be controlled by the following methods of farm practice:

First. Keep the plant in a good healthy growing condition. This can be done by having a good seed-bed made by deep fall or early winter plowing. Tne land plowed at this time will tend to conserve the moisture that falls during the winter and spring.

Second. Practice a two or three year crop rotation.

Third. Select the best of seed from good uninfected plants.

Fourth. Treat seed with a disinfectant when selection is impossible, such as oats, wheat, and potatoes.

Fifth. Practice field sanitation.

The question of time always comes up in regard to attending to some of these small jobs on the farm. It is true that a farmer is kept busy almost all the time, but it would be far more profitable to him if he had less land and smaller fields. In looking after the smaller things he could make his little fields bring larger returns than the man across the fence who is still trying to farm the whole plantation.

LEAF TOBACCO SALES FOR NOVEMBER, 1914.

Pounds sold for producers	37,996,472
Pounds sold for dealers	3,957,917
Pounds sold for warehouses	2,252,435
Total	44,206,824

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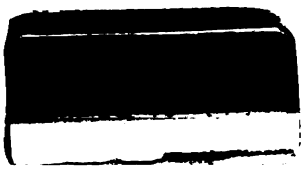

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